PACIFIC SALMON COMMISSION
JOINT CHINOOK TECHNICAL COMMITTEE

ANNUAL REPORT OF CATCH AND ESCAPEMENT FOR 2011

REPORT TCCHINOOK (12)-3

June 2012

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LIST OF ACRONYMS WITH DEFINITIONS

AABM	Aggregate Abundance Based Management
AC	Allowable Catch
AI	Abundance Index
ADF&G	Alaska Department of Fish and Game
AEQ	Adult Equivalent
Agreement	June 30, 1999 PST Annex and the Related Agreement
AUC	Area-Under-the-Curve
BC	British Columbia
CBC	Central British Columbia (Kitimat to Cape Caution)
CDFO	Canadian Department of Fisheries and Oceans
CI	Confidence Interval
COLR	Columbia River
CNR	Chinook Non-Retention
CR	Chinook Retention
CRITFC	Columbia River Intertribal Fish Commission
CRFMP	Columbia River Fish Management Plan
CTAC	Columbia River Technical Advisory Committee
CTC	Chinook Technical Committee
CU	Conservation Unit
CV	Coefficient of Variation
CWT	Coded Wire Tag
ESA	U.S. Endangered Species Act
FN	First Nations
FNC	First Nations Caucus
FR	Fraser River
GW	Gitwinksihlkw
IM	Incidental Mortality
ISBM	Individual stock based management
JDF	Juan De Fuca
LGS	Lower Strait of Georgia
MA	Management Agreement
MOC	Mid Oregon Coast
MR	Mark-Recapture
MSH	Maximum sustainable catch
MSY	Maximum Sustainable Yield for a stock, in adult equivalents
NA	Not Available
NC	North Coastal
NBC	Northern British Columbia (Dixon Entrance to Kitimat including Queen Charlotte Islands)
NMFS	National Marine Fisheries Service
NOC	Oregon Coastal North Migrating Stocks
NWIFC	Northwest Indian Fisheries Commission
ODFW	Oregon Department of Fish & Wildlife
ORC	Oregon Coast
PS	Puget Sound
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
QIN	Quinault Nation
QCI	Queen Charlotte Islands
SE	Standard Error
S_{msy}	Escapement producing MSY
SEAK	Southeast Alaska Cape Suckling to Dixon Entrance
SSP	Sentinel Stocks Program
SUS	Southern U.S.
SWVI	Southwest Vancouver Island
TAC	Total Allowable Catch
TBR	Transboundary Rivers (Alsek, Taku, Stikine)
UAF	University of Alaska Fairbanks
UGS	Upper Strait of Georgia
USFWS	U.S. Fish & Wildlife Service
U.S.	United States
WAC	Washington Coast (Grays Harbor northward)
WCVI	West Coast Vancouver Island excluding Area 20
WDFW	Washington Department of Fisheries and Wildlife

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EXECUTIVE SUMMARY

The June 30, 1999 Pacific Salmon Treaty (PST) Annex and the Related Agreement (Agreement) substantially changed the objectives and structure of the Pacific Salmon Commission's (PSC) Chinook salmon fisheries and assessment of Chinook salmon stocks. The 1999 Agreement replaced the previous ceiling and pass-through fisheries with Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries. The 2008 Agreement updated and refined several aspects of the 1999 Agreement while continuing with the approach of abundance based management of PSC Chinook salmon fisheries.

This report summarizes the 2011 fishery catches by region, provides available estimates of incidental mortality (IM) by fishery, and provides limited commentary on fishery catches where needed. Landed catch (LC) is reported in the appendices for each geographic area covered under the PST. A summary of estimates of LC, IM, and total mortality (TM) in nominal fish for all PSC AABM and ISBM fisheries is also provided.

This report also includes an assessment of escapement for stocks with Chinook Technical Committee (CTC) accepted goals, and escapement data through 2011 for all PST indicator stocks. The escapements of 50 naturally spawning escapement indicator stocks are reviewed annually, along with the results from the Sentinel Stocks Program (SSP). Biologically-based escapement goals have been accepted by the CTC for 25 of the 50 escapement indicator stocks/stock aggregates. For 12 of these, the escapement goal is defined as a range; for the remaining 13, the escapement goal is the point estimate of S_{MSY} (escapement producing maximum sustained yield). In 2011, the percentage of stocks meeting goal or goal ranges was 80%, the same rate as in 2010. Of the five stocks below goal, two stocks (Blossom and Hoh Spring/Summer) were within 15% of the target goal. Three stocks were more than 15% below goal: Situk, Cowichan, and Queets Spring/Summer. Data for stocks without accepted goals are presented to illustrate trends in escapement. The CTC will continue to review escapement goals, as they are provided to the committee.

The CTC retrospectively evaluated the performance of the stock groups and the criteria for initiating additional management action in regards to Paragraph 13c, based upon observed escapements and exploitation rates through 2011 and stock forecasts for 2012. No stock groups listed in Attachment I-III met the criteria for triggering additional management action. However, only five of the 10 different stock groups in Attachments I-III have stocks with agreed management objectives that can be evaluated for triggering additional management action, and nine of these stocks had forecasts available for 2012. The CTC has identified a need to develop management objectives and forecast capabilities for more of the stocks and stock groups included in Attachments I-III to improve the efficacy of Paragraph 13.

1 CHINOOK SALMON CATCH

The 1999 and 2008 Agreements substantially changed the objectives and structure of the PSC Chinook salmon fisheries. The 2008 Agreement eliminated the previous ceiling and pass-through fisheries and replaced them with AABM and ISBM fisheries. The 2008 Agreement defines catch limits for AABM fisheries while ISBM fisheries are limited by adult equivalent (AEQ) mortality rates. Chinook salmon catches for the AABM fisheries in 2011 are summarized in Table 1.1-Table 1.5. Chinook salmon catches in ISBM fisheries in 2011 are summarized in Tables 1.20 and

Table 1.21. Limited commentary on both AABM and ISBM fisheries is also provided. Historical catches for PSC Chinook salmon fisheries are given in Appendices A.1-A.15.

Starting with the report TCChinook (04)-4, the CTC included estimates of incidental mortalities associated with landed catch for each component of each AABM fishery. In the following year, the CTC also began reporting IM for most ISBM fisheries (CTC 2005). Chinook salmon encounters and IM are reported in Tables 1.6-1.19 for AABM fisheries, and in Tables 1.20-1.21 for ISBM fisheries.

Reports prior to TCChinook (04)-4 included a table providing coastwide summaries of all catches in PSC fisheries (e.g., CTC 2003). This summary was discontinued in the 2004 report because ISBM catch for the 2003 catch year was not included in CTC (2004a). Now that the CTC is providing a more comprehensive overview of LC and IM numbers for all AABM and ISBM fisheries, the CTC has reinitiated in this report a summary of LC, IM, and TM in terms of nominal fish for all PSC Chinook salmon fisheries (Table 1.22).

1.1 Review of Aggregate Abundance Based Management Fisheries

AABM fisheries for Chinook salmon are managed to achieve a target catch associated with each year's abundance index (AI) in Table 1 of the Agreement. AABM fisheries are mixed stock salmon fisheries that intercept and catch migratory Chinook salmon from many stocks. The AABM fisheries (Annex IV, Chapter 3, paragraph 2) are:

1) Southeast Alaska (SEAK) All Gear,
2) Northern BC (NBC) Troll and Queen Charlotte Islands (QCI) sport, and
3) West Coast Vancouver Island (WCVI) Troll and Outside Sport.

Catches for these three fisheries are reported in Table 1.1.

Table 1.1 Annual catches and hatchery add-ons for Aggregate Abundance Based Management fisheries, expressed in thousands of Chinook salmon. The treaty catches do not include the add-on or exclusions (see Section 1.1.1 and Appendix A.1). Notation is T for Troll, N for Net and S for Sport.

	Southeast Alaska (T, N, S)			Northern British Columbia (T), Queen Charlotte Islands (S)		West Coast Vancouver Island (T, S)	
	Treaty Catch		Hatchery	Treaty Catch		Treaty Catch	
Year	Limit[1]	Observed	Add-on	Limit[1]	Observed	Limit[1]	Observed
1999	184.2	198.8	47.7	126.1	86.7	107.0	36.4
2000	178.5	186.5	74.3	123.5	31.9	86.2	101.4
2001	250.3	186.9	77.3	158.9	43.5	145.5	117.7
2002	371.9	357.1	68.2	237.8	150.1	196.8	165.0
2003	439.6	380.2	57.2	277.2	191.7	268.9	175.8
2004	418.3	417.0	76.0	267.0	241.5	209.6	216.6
2005	387.4	392.0[3]	65.3	240.7	243.6	179.7	202.7
2006	354.5	362.9[3]	49.1	200.0	216.0	145.5	146.9
2007	329.4	329.8[3]	69.6	143.0	144.2	121.9	139.2
2008	152.9	173.4[3]	68.2	120.9	95.6	136.9	143.8
2009[2]	176.0	230.6[3]	65.2	139.1	109.5	91.3	124.6
2010	221.8	231.6	55.8	152.1	136.6	143.7	136.8
2011	283.3	290.7	67.4	186.8	122.7	134.8	204.2
2012	266.8			173.6		133.3	

[1]Allowable treaty catches correspond to the first post season abundance indices for 1999-2011 and the preseason abundance indices for 2012.

[2]2009 was the first year of implementation of the 2008 Agreement.

[3]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

1.1.1 Southeast Alaska Fisheries

The SEAK Chinook salmon fishery has been managed to achieve the annual all-gear PSC allowable catch (AC) through a plan established by the Alaska Board of Fisheries. Once the all-gear AC is determined from the preseason AI each spring, this plan establishes gear quotas for the troll, net, and sport fisheries. The current allocation plan reserves 4.3% of the total PSC catch for purse seine, 2.9% for drift gillnet and 1,000 fish for set gillnet fisheries. After the net quotas are subtracted, 80% of the remainder is allocated for the commercial troll and 20% for the sport fisheries. The commercial troll and net fisheries are managed in season according to management plans. Sport fishery bag and possession limits as well as annual limits are established prior to the season and based on the preseason AI. Regulatory history and maps for each SEAK fishery are described in CTC (2004b).

In addition, the SEAK fisheries are managed for:

1) An Alaska hatchery add-on estimated from CWT sampling. The add-on is the total estimated Alaskan hatchery catch, minus 5,000 base-period Alaskan hatchery catch, and minus the standard error (SE) for the total estimated Alaskan hatchery catch.
2) An exclusion of wild Chinook salmon originating from the Situk, Stikine and Taku Rivers, when appropriate according to Chapter 1 of the 2008 agreement.
3) Compliance with provisions established by the National Marine Fisheries Service in accordance with the U.S. Endangered Species Act (ESA).
4) Consistency with the provisions of the PST as required by the Salmon Fishery Management Plan of the North Pacific Fishery Management Council that was established by the U.S. Magnuson-Stevens Act.

The SEAK 2011 preseason AI of 1.69 allowed an all-gear PST catch of 294,800 Chinook salmon. The first postseason AI was 1.62, which corresponds to an allowable all-gear PST catch of 283,300. The preliminary total all-gear catch in 2011 was 358,797 with a PST catch of 290,715, an Alaska hatchery add-on of 67,384, and a terminal exclusion catch of 698. The all-gear PST catch was 2.6% above the postseason all-gear PST quota. Historical SEAK Chinook salmon catch numbers for 1975-2011 are included in Appendix A.1.

1.1.1.1 Troll Fisheries Catch

The troll fishery accounting year began with the start of the winter fishery on October 11, 2010 and ended with the summer fishery in September, 2011. The winter troll fishery continues until 45,000 Chinook salmon are caught or through April 30, whichever is earlier (Skannes and Hagerman 2011a). In 2011, the winter troll fishery was open through April 20. The spring fishery was managed so that each fishing area would not exceed a predetermined number of non-Alaskan Chinook salmon, based on the Alaska hatchery percentage in each of the areas (Skannes and Hagerman 2011a). The first summer fishery opening began on July 1 and was managed to catch 70% of the remaining troll gear Chinook salmon quota based on the pre-season AI (Skannes and Hagerman 2011b). After 70% of the summer quota was caught, the areas of high Chinook salmon abundance were closed and troll fishing effort was directed primarily at coho salmon. A second summer retention period to catch the remaining troll quota began on August 15 after necessary management actions for coho salmon were determined. In recent years, a small but increasing portion of the troll fleet has targeted chum salmon from mid-June through mid-August, resulting in a slight decrease in effort directed at Chinook and coho salmon.

In 2011, the troll fishery harvested 242,185 Chinook salmon, which included 24,989 Alaska hatchery fish. There was an Alaska hatchery add-on of 21,214 and a TBR exclusion of 209 fish, resulting in a total of 220,762 PST fish. The winter fishery harvested 50,817 fish, of which 3,780 were from Alaska hatcheries and 47,641 were PST fish. The spring fishery caught a total of 41,098, of which 16,953 were Alaska hatchery fish and 26,426 were PST fish. The total summer catch was 150,270, of which 4,256 were from Alaska hatcheries and 146,694 were PST fish (Table 1.2).

1.1.1.2 Net Fisheries Catch

There are three types of commercial net fisheries conducted in SEAK: purse seine, drift gillnet, and set gillnet. The 2011 total net catch was 56,074 Chinook salmon with 37,968 being Alaska hatchery fish. There was an Alaska hatchery add-on of 35,506 and a TBR exclusion of 488, resulting in a PST catch of 20,080 (Table 1.2).

The purse seine fishery is open from mid-June through early fall and is limited to specific areas and time periods established in season by emergency order (Davidson et al. 2011b). In 2011, a total of 26,404 Chinook salmon, which included 17,901 Alaska hatchery fish and 9,138 PST fish were caught in the purse seine fishery.

The drift gillnet fishery usually opens in late June, unless directed fisheries are implemented in May to target surplus production of Chinook salmon bound for the Taku and Stikine rivers, (Davidson et al. 2011a) as detailed in Chapter 1 of the 2008 agreement. In 2011, surplus production and associated allowable catches were identified in both the Taku and Stikine Rivers; however, the allowable catches were not large enough to implement directed commercial Chinook salmon fisheries in the U.S. and only liberalized sport fisheries took place. Overall, the drift gillnet fishery is limited to five traditional areas within the region and time periods are established in season by emergency order. The drift gillnet fishery caught a total of 28,547 Chinook salmon, including 20,068 Alaska hatchery fish and 9,819 PST fish.

The set gillnet fishery is managed to catch no more than 1,000 PST Chinook salmon, a limit which is based on a historic average, and is open during the late spring and summer in the Yakutat area. The set gillnet fishery caught 1,123 Chinook salmon, all of which were PST fish.

1.1.1.3 Sport Fishery Catch

Sport catches are monitored in season by creel surveys throughout the region, and sampling programs are in place to recover tags from coded-wire tagged Chinook salmon and coho salmon. The number of Alaska hatchery fish caught is estimated from the CWTs collected by the sampling program. Preliminary sport catch estimates are computed from the creel surveys while final sport catch estimates are computed from a mail out survey and are available one year after the fishery occurs. In 2011, Chinook salmon regulations for the sport fishery had a three fish daily bag limit and no annual limit for residents. Non-resident anglers had a one fish daily bag limit except during May, when the bag and possession limit was two. Nonresident anglers had an annual limit of five Chinook salmon. The minimum size limit of 28" (71 cm) in total length was in effect for both resident and non-resident anglers throughout the season. In some designated harvest areas near hatchery release sites, bag and possession limits and annual limits were liberalized to provide increased catches of returning Alaska hatchery Chinook salmon. The preliminary 2011 total sport Chinook salmon catch was 60,538 with an estimate of 12,047 Alaska hatchery fish. There was an Alaska hatchery add-on of 10,664 fish, resulting in a PST catch of 49,874 Chinook salmon (Table 1.2).

Table 1.2 Harvest of Chinook salmon in Southeast Alaska by gear type in 2011.

Gear	Total Catch	Alaska Hatchery Catch	Alaska Hatchery Add-on	Terminal Exclusion Catch[1]	AABM Catch[4]
Troll					
Winter	50,817	3,780	3,176	0	47,641
Spring	41,098	16,953	14,463	209	26,426
Summer	150,270[2]	4,256	3,575	0	146,694
Troll subtotal	242,185	24,989	21,214	209	220,762
Sport[3]	**60,538**	**12,047**	**10,664**	**0**	**49,874**
Net					
Set Net	1,123	0	0	0	1,123
Drift gillnet	28,547	20,068	18,240	488	9,819
Seine	26,404	17,901	17,266	0	9,138
Net subtotal	56,074	37,968	35,506	488	20,080
Total	358,797	75,005	67,384	698	290,715

[1]Terminal exclusion catch is a result of the harvest sharing arrangement on the Taku and Stikine Rivers.
[2]Includes 8 fish confiscated by the State of Alaska due to illegal fishing.
[3]Preliminary values until mail-out survey results are available.
[4]Treaty catch is the total catch minus Alaska hatchery add-on minus terminal exclusion catch. Totals may not equal the sum of the individual values due to rounding

1.1.2 British Columbia Fisheries

Under the 1999 PST Agreement, AABM regimes were implemented to constrain catch. This agreement extended through 2008 and was renewed in the 2008 PST Agreement that extends through 2018. The NBC AABM fishery includes NBC troll catch in Statistical Areas 1-5 and QCI sport catch in Statistical Areas 1 and 2. The total NBC AABM catch in 2011 was 122,660. The WCVI AABM fishery includes the WCVI troll and a portion of the WCVI sport fishery (defined below). The total WCVI AABM catch in 2011 was 204,232 (Table 1.3). Troll catches from 1996-2004 have been updated with data from CDFO (2009).

Table 1.3 Harvest of Chinook salmon by gear for Canadian AABM fisheries in 2011.

AABM Fishery	Troll	Sport	Total
Northern British Columbia	74,660	48,000	122,660
West Coast Vancouver Island	129,023	75,209	204,232

1.1.2.1 Northern British Columbia AABM

The total NBC AABM catch (troll plus sport) between October 1, 2010 and September 30, 2011 was 122,660 Chinook salmon (Table 1.3).

1.1.2.1.1 Northern British Columbia Troll Fishery Catch

The Northern British Columbia (NBC) troll fishery landed 74,660 Chinook salmon in 2011. The NBC troll fishery was opened for Chinook salmon fishing from June 9 to 21. The entire 2011 NBC Troll fishery was conducted under a system of individual transferable quotas. A total of 284 vessels were licensed but catch was conducted by 147 vessels, as much of the quota was transferred. Barbless hooks and revival boxes were mandatory in the troll fishery and the minimum size limit was 67 cm (26.4 in). No troll test fisheries were conducted in 2011. A ribbon boundary around Langara Island and from Skonun Point to Cape Knox on Graham Island excluded the commercial troll fishery from areas within one nautical mile of the shore for the duration of the fishery.

1.1.2.1.2 Northern British Columbia Sport Fishery Catch

Only the QCI sport catch is included in the AABM totals. Since 1995, catches in the QCI sport fisheries have been estimated by creel surveys, lodge logbook programs and independent observations by Canadian Department of Fisheries and Oceans (CDFO) staff. Catch for this fishery in 2011 was 48,000 Chinook salmon.

1.1.2.2 West Coast Vancouver Island AABM

Under the 2008 PST Agreement, the WCVI AABM fishery includes the WCVI troll and the outside WCVI sport fishery (defined below). The total AABM landed catch in the commercial troll, outside tidal sport, and First Nations (FN) troll in 2011 was 204,232 Chinook salmon (Table 1.3).

1.1.2.2.1 West Coast Vancouver Island Troll Fishery Catch

The AABM troll catch includes the commercial and FN troll caught Chinook salmon in Pacific Fishery Management Areas 21, 23-27, and 121-127. In the 2011 season (October 1, 2010-September 30, 2011), the WCVI troll fishing opportunities were consistent with a CDFO commitment to evaluate winter fisheries as a means to improve the economic base for the fleet and local communities while increasing flexibility in catch opportunities and reducing the catch rates on stocks encountered in summer fisheries (Table 1.4). Troll fishery openings were shaped by conservation concerns for Fraser River Spring run Age 1.2, Fraser River Spring run Age 1.3, WCVI, and Lower Strait of Georgia (LGS) Chinook salmon and interior Fraser River coho salmon.

To reduce impacts on Fraser and LGS Chinook salmon, Southwest Vancouver Island (SWVI) areas 123-124 were closed from March 1 to April 23. In addition, fisheries from April 19 to June 10 were managed to monthly effort quotas rather than catch quotas. To reduce impacts on interior coho, coho non-retention remained in effect for the spring/summer period, Fraser coho encounter rates were monitored, commercial fisheries were closed from mid-June through July, and plugs were used to avoid impacts on coho in August and early September fisheries. To reduce impacts on WCVI Chinook, near shore area closures were in effect from August through mid-September. To reduce impacts on LGS Chinook salmon, catch levels were reduced during the spring period when recent impacts were highest. This measure also provides some benefits to spring run U.S. Chinook salmon stocks when the mature run is abundant on the WCVI. Pacific Fishery Management Area 121 (Swiftsure Bank) remained closed in 2011. Selective fishing practices were mandatory, including single barbless hooks and "revival tanks" for resuscitating

coho salmon prior to release. The minimum size limits for commercial troll for all periods was 55 cm (21.6 in) (fork length).

The catch for 2011 commercial troll fisheries was 124,023 Chinook salmon (Table 1.4). The WCVI FN caught an estimated 5,000 Chinook salmon in 2011. Therefore, the total WCVI AABM troll catch for 2010 was 129,023 with 432 legal and 5,844 sublegal Chinook salmon releases (not including releases from the WCVI FN troll fisheries, which are currently unknown).

Table 1.4 Fishing periods and Chinook salmon caught and released during the 2011 catch year in the West Coast Vancouver Island commercial troll fishery.

Fishing Period[1]	Areas Open	Main Area Fished	Landed Catch	Legal Releases	Sub-legal releases
Feb 20-28	Areas; 23, 24, 25, 26, 27, 123, 124, 125, 126, 127	126	1,849	4	57
Mar 1-15	Areas; 23, 24, 25, 26, 27, 125, 126, 127	126	875	0	38
Apr 19-23	Areas; 23, 24, 25, 26, 27, 125, 126, 127	126/127	8,685	13	161
May 1-10, 15-18	Areas; 23, 24, 25, 26, 27, 124, 125, 126, 127	123/126	41,316	19	1,165
Jun 3-6, 9-10	Areas; 23, 24, 25, 26, 27, 123, 124, 125, 126, 127	123	34,395	100	2,993
Jul 24-27	Areas; 125, 126, 127	127	15,620	12	465
Aug 1-3	Areas; 123, 124, 125, 126, 127	123	21,283	18	669
Sep 1-5[2]	Area; 123	123		266	296
Total			124,023	432	5,844

[1]West Coast Vancouver Island troll fisheries were generally closed from mid-June to late August to avoid encounters of interior Fraser River and Thompson River coho and West Coast Vancouver Island Chinook salmon.
[2]DNA sampling of sublegal Chinook salmon by Area G.

1.1.2.2.2 West Coast Vancouver Island Sport Fishery Catch

The AABM sport fishery includes all catch in northwest WCVI (Areas 25–27, 125-127;) between October 16 through June 30, and the catch outside of one nautical mile offshore from July 1 through October 15, plus all the catch in southwest WCVI (Areas 21, 23, 24, 121, 123, & 124) from October 16 through July 31, and outside one nautical mile offshore from August 1 to October 15. Catch inside the surf line and outside the AABM periods specified above is included in ISBM fishery catch.

The WCVI AABM sport fishery occurs primarily in the Barkley Sound, outer Clayoquot Sound, and Nootka Sound areas. The majority of fishing effort occurs from mid-July through August in NWVI and August through mid-September in the SWVI. Creel surveys were conducted from early June to mid-September. The Chinook salmon daily bag limit was two Chinook salmon greater than 45 cm (17.7"). Barbless hooks were mandatory.

The 2011 WCVI AABM sport landed catch estimate during the creel period was 75,209 Chinook salmon (Table 1.5). Catch rates were determined from anglers interviewed from June 1 to September 15. No creel surveys occurred between October and May, when effort is relatively low.

Table 1.5 West Coast Vancouver Island AABM sport fishery catches of Chinook salmon by Pacific Fishery Management Areas in 2011 representing catch from June 1 to September 15 only.

Pacific Fishery Management Areas						
21/121	**23/123**	**24/124**	**25/125**	**26/126**	**27/127**	**Total**
8,912	32,732	16,701	5,472	5,353	6,039	75,209

1.2 Estimates of Incidental Mortalities in AABM Fisheries

1.2.1 Southeast Alaska Fisheries

Estimates of encounters and IM in SEAK fisheries are shown in Table 1.6 to Table 1.11. Estimates were converted from landed catch into treaty catch by multiplying the landed catch estimate of encounters by the ratio of treaty catch to landed catch for each respective fishery. The 2011 troll encounters were estimated from regressions of historical encounter estimates and troll effort. The regression predicts encounter estimates from troll effort using encounter estimates obtained from direct fishery observation programs conducted during a series of years. The retention and CNR sublegal regressions use a data series from 1998-2006, while the CNR legal regression uses a data series from 1985-1988 and 1998-2006 (CTC 2011). Sport fishery releases were computed from the number of Chinook salmon caught and released as recorded on the annual Statewide Catch Survey (mail-in survey) forms. Legal and sublegal CNR purse seine encounters were calculated using a modified catch per landing approach that uses the relationship between the yearly catch and the magnitudes of legal and sublegal CNR encounters for years where direct observational data are available (CTC 2011). For the gillnet fishery, drop-off mortality was estimated as a percentage of the landed catch using the regional-specific drop-

off rate for SEAK (CTC 2004c). Encounter estimates are multiplied by the respective IM rate found in CTC (1997) to obtain estimates of IM.

Table 1.6 Estimated treaty encounters in Southeast Alaska troll fisheries for 2002-2011.

	Summer CNR Period		CR Period
Year	Legal Encounters	Sublegal Encounters	Sublegal Encounters
2002	27,647	50,981	75,436
2003	37,529	17,620	59,170
2004	52,445	25,620	33,245
2005	43,264	19,077	33,978[1]
2006	37,194	27,845	37,940[1]
2007	39,758	26,331	56,067[1]
2008	48,893	32,380	30,696[1]
2009	47,268	31,304	38,494[1]
2010	56,575	37,468	31,485[1]
2011	54,688	36,218	37,696

Refer to List of Acronyms for definitions.

[1]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

Table 1.7 Estimated treaty releases in Southeast Alaska sport fisheries for 2002-2011.

Year	Legal Releases	Sublegal Releases
2002	25,484	38,297
2003	21,225	42,791
2004	31,859	45,488
2005[1]	22,328	59,244
2006[1]	22,891	55,221
2007[1]	18,891	55,590
2008	21,644	29,535
2009	19,389	40,442
2010	13,569	28,649
2011[2]	-	-

[1]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

[2]Not available until mail-out survey results are complete, but an estimate was included in the coastwide summary (Table 1.22).

Table 1.8 Estimated treaty encounters in Southeast Alaska net fisheries for 2002-2011.

	Seine CNR Period		Seine CR Period
Year	Legal Encounters	Sublegal Encounters	Sublegal Encounters
2002	200	530	1,212
2003	581	1,544	9,437
2004	9,176	1,018	3,996
2005	0	0	5,520
2006	0	0	6,127
2007	7,472	19,844	6,572
2008	79	210	101
2009	0	0	4,094
2010	75	198	97
2011	453	1,203	1,924

Refer to List of Acronyms for definitions.

Table 1.9 Estimated treaty incidental mortalities in Southeast Alaska troll fisheries for 2002-2011.

Year	LIM Drop-off	LIM CNR	LIM Total	SIM CNR	SIM CR	SIM Total
2002	2,385	6,055	8,440	13,408	19,840	33,248
2003	2,459	8,219	10,678	4,634	15,562	20,196
2004	2,575	11,486	14,061	6,738	8,744	15,482
2005	2,437[1]	9,475	11,912[1]	5,017	8,936[1]	13,953[1]
2006	2,114[1]	8,146	10,259[1]	7,323	9,978[1]	17,301[1]
2007	1,923[1]	8,707	10,630[1]	6,925	14,746[1]	21,671[1]
2008	1,011[1]	10,708	11,719[1]	8,516	8,073[1]	16,589[1]
2009	1,272[1]	10,352	11,624[1]	8,233	10,124[1]	18,357[1]
2010	1,422[1]	12,390	13,812[1]	9,854	8,281[1]	18,135[1]
2011	1,766	11,977	13,743	9,525	9,914	19,439

Refer to List of Acronyms for definitions.

[1]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

Table 1.10 Estimated treaty incidental mortalities in Southeast Alaska sport fisheries for 2002-2011.

Year	LIM Drop-off	LIM CR	LIM Total	SIM Total
2002	1,638	4,052	5,690	6,089
2003	1,773	3,375	5,147	6,804
2004	1,995	5,066	7,060	7,233
2005[1]	2,304	3,550	5,796	9,420
2006[1]	2,519	3,640	6,147	8,780
2007[1]	2,244	3,004	5,209	8,939
2008	1,176	3,441	4,618	4,696
2009	1,731	3,083	4,814	6,430
2010	1,594	2,157	3,752	4,555
2011[2]	1,795[3]	-	-	-

Refer to List of Acronyms for definitions.
[1]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.
[2]Final estimates not available until mail-out survey results are complete.
[3]Preliminary estimate using catch estimate from creel survey.

Table 1.11 Estimated treaty incidental mortalities in Southeast Alaska net fisheries for 2002-2011.

Year	LIM Drop-off[1]	LIM CNR	LIM Total	SIM CNR	SIM CR	SIM Total
2002	147	102	249	390	1,040	1,429
2003	118	297	415	1,135	8,097	9,232
2004	221	4,680	4,901	748	3,429	4,177
2005	203[2]	0	203[2]	0	4,736	4,736
2006	271[2]	0	271[2]	0	5,257	5,257
2007	212[2]	3,811	4,023[2]	14,585	5,639	20,224
2008	219[2]	40	259[2]	154	87	241
2009	200[2]	0	200[2]	0	3,512	3,512
2010	131	38	169	146	83	229
2011	218	231	449	884	1,651	2,535

Refer to List of Acronyms for definitions.
[1]Includes set gillnet and drift gillnet.
[2]Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

1.2.2 British Columbia Fisheries

1.2.2.1 Northern British Columbia Fisheries

Table 1.12 and Table 1.13 summarize encounters for the NBC AABM fisheries from 2002 to 2011 by size class during retention and Chinook Non-Retention (CNR) fishing periods. Releases for the NBC troll fishery are based on logbook data. Encounters for the QCI sport fishery are based on creel survey and logbook programs. Table 1.14 and Table 1.15 summarize the incidental mortalities associated with the NBC troll and sport encounters. Tables 1.14 and 1.16 presents IM estimates using size specific rates from the CTC (1997). The estimated total in 2011 was 141,279 nominal fish, including 122,660 fish in the landed catch and 18,619 fish from IM (Table 1.14 and Table 1.15).

Table 1.12 Estimated Chinook salmon releases in Northern British Columbia aggregate abundance based management troll fishery for 2002-2011.

Year	Legal Releases	Sublegal Releases[1]
2002	5,240	3,714
2003	11,649	2,936
2004	24,500	10,210
2005	9,632	19,380
2006	3,310	11,095
2007	3,355	12,926
2008	1,496	5,554
2009	2,910	12,974
2010	2,075	9,816
2011	31,994	7,482

[1]Troll sublegal releases have been corrected by a factor of 1.67 to account for underreporting. (Vélez-Espino et al. (2010)

Table 1.13 Estimated Chinook salmon releases in Northern British Columbia aggregate abundance based management sport fishery for 2002-2011.

Year	Legal Releases[1]	Sublegal Releases
2002	42,226	0
2003	47,549	0
2004	116,741	0
2005	60,987	0
2006	32,480	0
2007	35,527	0
2008	10,649	0
2009	17,234	0
2010	32,117	0
2011	46,453	0

[1]Sport releases are reported as 'mixed' sizes. However, since >90% of such releases are legal-sized, all reported releases were considered to be legal-sized for the purpose of estimating incidental mortality.

Table 1.14 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in Northern British Columbia aggregate abundance based management troll fishery for 2002-2011.

Northern British Columbia Troll – Aggregate Abundance Based Management							
Year	LIM Dropoff	LIM CR	LIM CNR	Total LIM	SIM CR	SIM CNR	Total SIM
2002	1,751	0	1,085	2,836	839	42	880
2003	2,378	0	2,465	4,843	643	53	696
2004	2,878	133	5,280	8,291	648	1,772	2,420
2005	2,972	801	1,342	5,114	3,296	1,297	4,593
2006	2,575	560	111	3,245	2,469	160	2,630
2007	1,415	484	214	2,114	2,536	527	3,063
2008	886	90	212	1,189	1,156	160	1,316
2009	1,283	85	538	1,905	1,768	1,307	3,075
2010	1,534	126	293	1,953	1,360	967	2,326
2011	1,269	0	6,463	7,732	1,241	532	1,773

Refer to List of Acronyms for definitions.

Table 1.15 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in Northern British Columbia aggregate abundance based management sport fishery for 2002-2011.

Northern British Columbia Sport – Aggregate Abundance Based Management				
Year	LIM Dropoff[1]	LIM CR	Total LIM	Total SIM
2002	1,696	6,714	8,410	0
2003	1,955	7,560	9,515	0
2004	2,664	18,562	21,226	0
2005	2,477	9,697	12,174	0
2006	2,322	5,164	7,486	0
2007	2,196	5,649	7,845	0
2008	1,566	1,693	3,259	0
2009	1,224	2,740	3,964	0
2010	1,670	5,107	6,777	0
2011	1,728	7,386	9,114	0

[1]Legal drop-off mortality is computed from landed catch, incorporating both an encounter ratio and a mortality rate.
Refer to List of Acronyms for definitions.

1.2.2.2 West Coast Vancouver Island Fishery

The estimated total mortality of Chinook salmon in the WCVI AABM fisheries in 2011 was 221,237 nominal fish, including 204,232 Chinook salmon in the landed catch and 17,005 Chinook salmon from IM (Table 1.16 and Table 1.17). The estimated IM included 11,941 legal and 5,064 sublegal nominal Chinook salmon. Table 1.18 and Table 1.19 summarize encounters

for these fisheries by size class during retention and CNR fisheries. In 2011, a non-retention AABM troll fishery opened in September to collect DNA samples from sublegal Chinook salmon.

Table 1.16 Estimated Chinook salmon releases in West Coast Vancouver Island aggregate abundance based management troll fishery.

Year	Legal Releases	Sublegal Releases [1]
2002	7,943	22,485
2003	70	25,850
2004	0	17,415
2005	550	17,248
2006	3,522	12,789
2007	250	14,405
2008	65	12,079
2009	345	6,976
2010	375	8,170
2011	432	9,759

[1]Troll sublegal releases have been corrected by a factor of 1.67 to account for underreporting.

Table 1.17 Estimated Chinook salmon releases in West Coast Vancouver Island aggregate abundance based management sport fishery.

Year	Legal Releases	Sublegal Releases
2002	12,326	7,507
2003	23,156	6,333
2004	16,061	5,485
2005	19,323	4,571
2006	11,882	6,048
2007	5,973	15,590
2008	14,483	8,068
2009	16,520	27,863
2010	35,879	9,873
2011	23,285	14,328

Table 1.18 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in West Coast Vancouver Island aggregate abundance based management troll fishery for 2002-2011.

West Coast Vancouver Island Troll – Aggregate Abundance Based Management[1]							
Year	LIM Dropoff	LIM CR	LIM CNR	Total LIM	SIM CR	SIM CNR	Total SIM
2002	2,149	0	1,604	3,754	5,329	0	5,329
2003	2,495	0	14	2,509	6,126	0	6,126
2004	2,995	0	0	2,995	4,127	0	4,127
2005	2,530	111	0	2,641	4,088	0	4,088
2006	1,853	86	625	2,565	2,738	293	3,031
2007	1,603	51	0	1,653	3,414	0	3,414
2008	1,618	13	0	1,631	2,863	0	2,863
2009	989	27	43	1,059	1,551	103	1,653
2010	1,430	26	50	1,506	1,869	67	1,936
2011	2,193	34	54	2,281	2,196	117	2,313

[1]West Coast Vancouver Island troll catch data has been corrected from TCCHINOOK 11-1 to remove "out of area" data.
Refer to List of Acronyms for definitions.

Table 1.19 Estimated Chinook salmon legal incidental mortality and sublegal incidental mortality in West Coast Vancouver Island aggregate abundance based management sport fishery for 2002-2011.

West Coast Vancouver Island Sport – Aggregate Abundance Based Management				
Year	LIM Dropoff	LIM CR	Total LIM	Total SIM
2002	2,174	2,367	4,540	1,441
2003	1,851	4,446	6,297	1,216
2004	2,697	3,084	5,781	1,053
2005	3,497	3,710	7,207	878
2006	2,519	2,281	4,800	1,161
2007	3,196	1,147	4,343	2,993
2008	3,488	2,781	6,269	1,549
2009	4,583	3,172	7,755	5,350
2010	3,790	6,889	10,679	1,896
2011	5,189	4,471	9,660	2,751

Refer to List of Acronyms for definitions.

1.3 Review of Individual Stock Based Management Fisheries

Individual stock based management (ISBM) fisheries include all British Columbia Chinook salmon fisheries that are not included in the NBC and WCVI AABM fisheries, and all marine and freshwater Chinook salmon fisheries in Washington, Oregon, and Idaho. ISBM fisheries are managed with the intent of meeting management objectives for individual stocks listed in Attachments IV and V to Chapter 3, Annex IV to the Pacific Salmon Treaty.

1.3.1 Canadian Individual Stock Based Management Fisheries

The Canadian ISBM fisheries include all fisheries that catch or release Chinook salmon in British Columbia that are not AABM fisheries. In 2011, 278,162 Chinook salmon were caught in Canadian ISBM fisheries in British Columbia and Canadian sections of the trans-boundary Alsek, Taku and Stikine rivers. Total estimated IM in 2011 was 23,427 legal and 8,867 sublegal Chinook salmon. The distribution of the landed catches and estimated incidental mortalities are presented in Appendices A.2 through A.8.

Table 1.20Landed catch and incidental mortalities in Canadian Individual Stock Based Management fisheries for 2011.

Region	Fishery	Landed Catch	Release Legal	Release Sublegal	Total IM - Legal	Total IM - Sublegal	Total Incidental Mortality
Transboundary Rivers	Gillnet	3,209	158	0	297	0	297
(Taku, Stikine, Alsek)	Freshwater Sport	253	275	0	70	0	70
	First Nations	736	0	0	34	0	34
Regional Total		4,198	433	0	401	0	401
Northern BC	Gillnet	3,586	0	0	165	0	165
	Tyee Test Fishery	976	0	0	45	0	45
	Tidal Sport	14,677	500	1,746	608	278	885
	Freshwater Sport	2,540	0	0	175	0	175
	First Nations	10,863	0	0	500	0	500
Regional Total		32,642	500	1,746	1,493	278	1,770
Central BC	Gillnet	4,794	0	0	221	0	221
	Tidal Sport	7,701	423	75	344	12	356
	Freshwater Sport	646	0	0	45	0	45
	First Nations	2,323	0	0	107	0	107
Regional Total		15,464	423	75	716	12	728
WCVI Terminal	Gillnet	21,843	338	0	1,325	0	1,325
	Seine	0	17	0	12	0	12
	Tidal Sport	52,131	6,081	9,458	4,765	1,816	6,581
	First Nations GN	22,794	0	0	1,049	0	1,049
Regional Total		96,768	6,436	9,458	7,150	1,816	8,966
Johnstone Strait	Troll	0	36	0	7	0	7
	Gillnet	6	74	0	70	0	70
	Seine	40	2,238	0	1,640	0	1,640
	Tidal Sport	11,934	1,952	3,217	1,198	618	1,816
	First Nations	268	0	0	12	0	12
Regional Total		12,248	4,300	3,217	2,928	618	3,546
Georgia Strait	Troll	0	177	0	36	0	36
	Gillnet	3	19	0	18	0	18
	Seine	0	94	0	68	0	68
	Tidal Sport	21,651	2,072	18,255	1,892	3,505	5,397
	First Nations	2,379	17	0	126	0	126
Regional Total		24,033	2,379	18,255	2,139	3,505	5,644
Juan de Fuca	Gillnet	278	7	249	19	236	255
	Seine	0	389	877	280	631	912
	Tidal Sport	21,075	3,648	9,230	2,155	1,772	3,927
Regional Total		21,353	4,044	10,356	2,454	2,639	5,093
Fraser River	Gillnet	5,488	104	0	351	0	351
	Mainstem Sport	13,983	847	0	1,127	0	1,127
	First Nations-FSC	33,118	96	0	1,614	0	1,614
	First Nations Comm	8,066	239	0	597	0	597
	Trib Sport	6,366	8,175	0	2,009	0	2,009
	Test Fishery	4,435	257	0	447	0	447
Regional Total		71,456	9,718	0	6,146	0	6,146
Grand Total		278,162	28,233	43,107	23,427	8,867	32,294

Refer to List of Acronyms for definitions.

1.3.2 Southern U.S. Individual Stock Based Management Fisheries

Southern U.S. fisheries of interest to the PSC, generally those north of Cape Falcon, Oregon, are managed in accordance with legal obligations stemming from treaties between Indian tribes and the United States. In 1974, *U.S. v Washington* set forth sharing obligations to meet treaty fishing rights in western Washington. Treaty rights of Columbia River tribes were defined by *U.S. v Oregon*, and the Columbia River Fisheries Management Plan was implemented in 1977. In reporting these fisheries, fisheries are termed "treaty" if they are fishing under the Native American Treaty fishing rights and "non treaty" otherwise. As specified in the 2008 agreement, all southern U.S. fisheries are ISBM fisheries. Historical catches in these fisheries may be found in Appendices A.9 through A.14.

1.3.2.1 Strait of Juan de Fuca and the San Juan Islands

The preliminary estimate of the 2011 Chinook salmon catch in Strait of Juan de Fuca tribal net fisheries was 352 fish with the majority of these taken during fisheries targeting Fraser River sockeye. There were 5,810 Chinook salmon harvested in the San Juan Islands net fisheries. The preliminary estimate of the 2011 Strait of Juan de Fuca treaty troll fishery is 4,090 Chinook salmon through December. The catch estimate does not include catches from Area 4B during the May-September Pacific Fisheries Management Council management period. Historic catch estimates are provided in Appendices A.9 and A.10 for the Strait of Juan de Fuca and San Juan areas respectively.

1.3.2.2 Puget Sound

The preliminary estimate of the 2011 tribal and non-tribal net fishery harvests in Puget Sound marine areas is 65,403 (55,384 tribal, 10,019 non-tribal) for all marine areas excluding Strait of Juan de Fuca (Area 4B, 5, 6, 6A, 6B, and 6C) and San Juan Islands (Area 7 and 7A). Additional tribal net harvest occurred in freshwater fisheries with a preliminary estimate of 35,289. Estimates of the sport catch in 2011 are not yet available from creel census and Catch Record Card (CRC) accounting system. Estimates of the sport catch for 2011 is the average of the previous three years. Historic catch tables for Puget Sound exclusive of the Strait of Juan de Fuca and San Juan Islands are provided in Appendix A.11.

1.3.2.3 Washington Coast Terminal

Tribal commercial, ceremonial and subsistence fisheries harvested 11,559 Chinook salmon in north coastal rivers (Quinault, Queets, Hoh, and Quillayute) in 2011. An additional two Chinook salmon were harvested by the Makah tribal fisheries in the Waatch and Sooes Rivers.

Harvest in Grays Harbor includes catch from both the Humptulips and Chehalis Rivers. The 2011 tribal net fisheries harvested an estimated 6,402 Chinook salmon. The 2011 non-Indian commercial net harvest in Grays Harbor was 2,121 Chinook salmon. Approximately 18,950 Chinook salmon were harvested by non-Indian commercial net fisheries in Willapa Bay in 2011.

From Grays Harbor north, sport fisheries were implemented based upon pre-season tribal-state agreements and were subject to in-season adjustment. Estimates of sport fishery catches for Washington coastal terminal fishing areas in 2011 are not available from the CRC accounting

system an annual basis, but are estimated from the average catch from the previous three years. Historic catch estimates for Washington Coastal inside fisheries are shown in Appendix A.12.

1.3.2.4 North of Cape Falcon

Ocean fisheries off the coasts of Washington, Oregon, and California are managed under regulations recommended by the Pacific Fishery Management Council. The estimated catch of Chinook salmon in commercial troll fisheries from Cape Falcon, Oregon to the U.S.-Canada border in 2011 was 61,423 for both treaty and non-treaty fisheries combined. Estimated catch in the ocean sport fishery north of Cape Falcon in 2011 was 30,826 Chinook salmon. Historic catch estimates for U.S. ocean fisheries north of Cape Falcon are shown in Appendix A.13.

1.3.2.5 Columbia River

Chinook salmon from the Columbia River are divided into eight stock groups for management purposes. These groups are delineated by run timing and area of origin: (1) spring run originating below Bonneville Dam; (2) spring run originating above Bonneville Dam; (3) summer run originating above Bonneville Dam; (4) fall run returning to Spring Creek Hatchery; (5) fall run originating in hatchery complexes below Bonneville Dam; (6) wild fall run originating below Bonneville Dam; (7) upriver bright fall run; and (8) mid-Columbia bright fall hatchery fish.

In 2011, the total annual harvest for all fisheries (spring, summer and fall) in the Columbia River basin was 424,439 Chinook salmon, which included non-Indian commercial net harvest of 99,075, sport harvest of 132,109 and treaty Indian commercial, ceremonial and subsistence harvest of 193,255 Chinook salmon. Historic catch estimates for Columbia River fisheries are shown in Appendix A14.

1.3.2.6 Oregon Coast Terminal

Most harvest in ocean fisheries off Oregon's coast is comprised of a mixture of southern Chinook salmon stocks not included in the PSC agreement. These stocks do not migrate north into the PSC jurisdiction to any great extent. Some stocks originating from Oregon coastal streams do migrate into PSC fisheries, including the North Oregon Coastal (NOC) and Mid-Oregon Coastal (MOC) stock aggregates. The NOC stocks are harvested only incidentally in Oregon ocean fisheries, while the contribution of MOC stocks to Oregon ocean fisheries is believed to be much greater (based on CWT distribution data). Catch statistics are readily available only for a terminal area troll fishery on one MOC stock at the mouth of the Elk River. Late season (October-December) troll catch in the Elk River terminal troll fishery in 2011 was 1,954 Chinook salmon.

Sport catch of these two stock groups occurs primarily in estuary and freshwater areas as mature fish return to spawn and is reported through a "punch card" accounting system. These data are only available more than two years after the current season. Therefore, only the in river and estuary sport catch through observed values in 2009 is reported for the NOC and MOC groups. The 2009 punch card estimate of estuary and freshwater catch for the NOC and MOC groups is 6,537 Chinook salmon. Estimates have been made using correlations between escapement and catch to represent best estimates of terminal sport catch for 2010 and 2011 that are represented in

Table 1.21. Historical catch estimates for the Elk River troll fishery and the estuary and freshwater sport fisheries targeting on MOC and NOC stocks are shown in Appendix A.15.

1.3.3 Estimates of Incidental Mortality for Southern U.S. Fisheries

Table 1.21 shows estimates of incidental mortalities for southern U.S. fisheries in marine and river fisheries in Puget Sound, on the Washington and Oregon coast north of Cape Falcon, Oregon coast terminal fisheries, and in the Columbia River Fisheries. Incidental mortality was calculated using the release mortality, drop-out, and drop-off mortality rates assigned for areas and gears in CTC (1997). Number of fish released is from creel interviews, voluntary trip-reports, on-water monitoring, or extrapolated from similarly structured fisheries with known release information data.

Table 1.21Estimated incidental mortality in Southern U.S. troll, net, and sport fisheries for 2009-2011.

Fishery	Gear	2011			2010			2009		
		LC	Releases	IM	LC	Releases	IM	LC	Releases	IM
Juan de Fuca	Net	352	0	28	1,339	0	107	99	0	8
	Sport	9,173[1]	29,104[1]	9,130	11,508	33,953	10,768	11,167	37,990	11,801
	Troll	4,090	3,676	1,003	2,011	1,808	493	3,280	2 948	804
Fishery Total		*13,615*	*32,780*	*10,161*	*14,858*	*35,760*	*11,368*	*14,546*	*40,939*	*12,613*
San Juans	Net	5,810	11,045	9,301	5,950	4,973	4,454	1,014	2,012	1,691
	Sport	4,354[1]	4,496[1]	1,836	3,157	2,311	1,077	4,077	5,159	1,974
Fishery Total		*10,164*	*15,541*	*11,137*	*9,107*	*7,284*	*5,531*	*5,091*	*7,171*	*3,665*
Puget Sound	Net	100,692	596	8,090	72,576	78	5,811	68,764	596	5,535
	Sport	34,373[1]	103,296 [1]	28,073	32,524	70,204	20,141	33,338	127,720	33,650
Fishery Total		*135,065*	*103,892*	*36,163*	*105,100*	*70,282*	*25,951*	*102,102*	*128,316*	*39,186*
Wash Inside Coastal	Net	39,034	0	781	12,794	0	256	18,728	0	375
	Sport	5,756[1]	908[1]	571	6,831	1,077	678	6,629	1,045	658
Fishery Total		*44,790*	*908*	*1,352*	*19,625*	*1,077*	*934*	*25,357*	*1,045*	*1,033*
Columbia River	Net	292,330	7,258	10,606	330,820	8,058	11,989	189,480	3,095	6,507
	Sport	132,109	23,792	11,947	155,745	22,766	13,496	85,074	14,298	7,516
Fishery Total		*424,439*	*31,050*	*22,553*	*486,564*	*30,825*	*25,485*	*274,554*	*17,393*	*14,022*

Wa/Or North Falcon	**Sport**	30,826	32,338	5,683	38,686	10,177	2,571	13,331	6,694	1,364
	Troll	61,423	29,367	8,731	88,565	36,919	11,259	25,410	19,509	5,415
Fishery Total		*92,249*	*61,705*	*14,414*	*127,251*	*47,096*	*13,830*	*38,741*	*26,203*	*6,779*
Oregon Inside	**Sport**	27,353[2]	8,445[2]	845[2]	22,362[2]	6,228[2]	623[2]	6,537	3,685	368
	Troll	1,954	NA	586	1,315	NA	395	293	NA	88
Fishery Total		29,307	8,445	1,431	23,677	6,228	1,018	6,830	3,685	456
GRAND TOTAL		**749,629**	**254,321**	**97,211**	**786,182**	**198,552**	**84,117**	**467,221**	**224,752**	**77,754**

[1] WDFW CRC estimates of landed catch were not yet available; LC and releases for 2011 were computed using 2008-2010 mean values.

[2] The catch estimate is not yet available. Both landed catch and releases are based on the relationship between historical estimates of catches, escapements and releases. IM is imputed onto estimates of releases in accordance with mortality rates agreed to by PFMC MEW document "FISHERY REGULATION ASSESSMENT MODEL (FRAM) An Overview for Coho and Chinook – v 3.0"

1.4 Summary of 2011 Coastwide LC, IM, and TM in PSC Fisheries

The CTC reinitiates in this report a coastwide summary of Chinook salmon catches in PSC fisheries. The summary, for the first time, also includes estimates of IM and TM for the fisheries. The CTC discontinued the coastwide summary of LC in report TCChinook (04)-4 because of incomplete data reporting for some fisheries. However, the CTC finds that the estimates numbers are now sufficiently comprehensive to provide reasonable coastwide totals for the AABM and ISBM fisheries (Table 1.22). For some component fisheries, complete data for 2011 LC and IM are not yet available. For the SEAK AABM, the 2011 SEAK sport LC is a preliminary estimate, and 2011 IM for the SEAK sport fishery is estimated from the 2010 IM:LC ratio. For the US ISBM, data for a number of sport fisheries are not yet available: Juan de Fuca sport; Puget Sound sport; Washington Coast terminal sport; and Oregon Coast terminal sport. Both landed catch and releases for these ISBM component fisheries are based on estimates of historical levels of catch, escapement and release (Table 1.21). This approach provides a better estimate of the total 2011 LC and IM than having no LC or IM from these fisheries represented in the totals.

The preliminary estimate of total LC of Chinook salmon for all PSC fisheries in 2011 is 1,713,480, of which 1,108,426 were taken in U.S. fisheries and 605,054 in Canadian fisheries (Table 1.22). Total IM associated with this harvest was 221,972 Chinook salmon, in nominal fish. The TM in nominal fish was 1,935,452 Chinook salmon, of which 1,262,480 was taken in US fisheries and 672,972 in Canadian fisheries. For U.S. fisheries, 68% of the LC and TM occurred in ISBM fisheries, whereas in Canada, 46% of the LC and TM occurred in ISBM fisheries.

Table 1.22. Summary in nominal fish of preliminary estimates for landed catch (LC), incidental mortality, and total mortality (TM) for US and Canada AABM and ISBM fisheries in 2011.

	2011		
Fishery	**LC**	**IM**	**TM**
SEAK AABM	290,715	45,935	336,650
SEAK hatchery add-on and terminal exclusion	68,082	10,908	78,990
US ISBM	749,629	97,211	846,840
US TOTAL	**1,108,426**	**154,054**	**1,262,480**
NBC AABM	122,660	18,619	141,279
WCVI AABM	204,232	17,005	221,237
CANADA ISBM	278,162	32,294	310,456
CANADA TOTAL	**605,054**	**67,918**	**672,972**
PST FISHERIES TOTAL	**1,713,480**	**221,972**	**1,935,452**

2 CHINOOK SALMON ESCAPEMENTS

2.1 Introduction

The Agreement established a Chinook salmon management program that:

"introduces catch regimes that are based on estimates of Chinook salmon abundance, that are responsive to changes in Chinook salmon production, that take into account all fishery induced mortalities and that are designed to meet MSY or other agreed biologically-based escapement objectives"

This chapter compares annual escapement estimates with maximum sustained yield (MSY) or other agreed biologically-based escapement goals established for Chinook salmon stocks. The CTC has reviewed and accepted escapement goals for 25 stocks included in this report.

This annual report, like those prior to 2006 (see CTC 2005) includes a section on the framework used for escapement assessments and narratives for each stock that includes a description of escapement methodology, escapement goal basis, and agency comments. Annual reports from 2006-2011 used an abbreviated narrative for each stock.

Escapement goals accepted by the CTC were based on analyses that followed the guidelines developed in the CTC escapement goal report (CTC 1999). In the stock-specific narratives presented with the escapement graphs, only CTC-accepted escapement goals and ranges (in gray shading) are shown on the escapement graphs and used for evaluation. Table 2.1 presents the status of escapement goal reviews by the CTC for stocks identified as escapement indicator stocks.

Table 2.1 Pacific Salmon Commission Chinook salmon escapement indicator stocks, where shading indicates that there is not a Chinook Technical Committee accepted escapement goal for assessment of stock status.

Presence in Treaty Attachments					Stock Group In Att. I-V	Escapement Indicator	Region	Run
SEAK	NBC/ QCI	WCVI	BC ISBM	SUS ISBM				
✔						Situk	Yakutat	Spring
✔						Chilkat	N Inside	Spring
✔						King Salmon	N Inside	Spring
✔						Andrew Creek	C Inside	Spring
✔						Unuk	S Inside	Spring
✔						Chickamin	S Inside	Spring
✔						Blossom	S Inside	Spring
✔						Keta	S Inside	Spring
✔						Alsek	TBR	Spring
✔						Taku	TBR	Spring
✔						Stikine	TBR	Spring
✔	✔		✔		North/Central British Columbia	Yakoun	NBC-Area 1	Summer
✔	✔		✔		North/Central British Columbia	Nass	NBC-Area 3	Spring/Summer
✔	✔		✔		North/Central British Columbia	Skeena	NBC-Area 4	Spring/Summer
			✔		North/Central British Columbia	Dean	CBC-Area 8	Spring
						Rivers Inlet	CBC-Area 9	Spring/Summer
✔	✔		✔		West Coast Vancouver Island Falls	Arthsh, Burman, Kaouk, Tahsis, Tashish, Marble	WCVI	Fall
✔	✔		✔		Upper Strait of Georgia	Khsahni , Kakweakan, Wakeman, Kingcome, Nimpkish	UGS	Sum/Fall
			✔		Lower Strait of Georgia	Cowichan/Nanaimo[2]	LGS	Fall
✔	✔		✔		Fraser Early[1] (Spr/Sum)	Fraser Spring 1 3	FR	Spring
✔	✔		✔		Fraser Early[1] (Spr/Sum)	Fraser Spring 1.2	FR	Spring
✔	✔		✔		Fraser Early[1] (Spr/Sum)	Fraser Summer 1 3	FR	Summer
✔	✔		✔		Fraser Early[1] (Spr/Sum)	Fraser Summer 0.3	FR	Summer
		✔	✔	✔	Fraser Late	Harrison	FR	Fall
			✔	✔	North Puget Sound Natural Springs	Nooksack	NC/PS	Spring
			✔	✔	North Puget Sound Natural Springs	Skagit Spring	NC/PS	Spring
		✔	✔	✔	Puget Sound Natural Summer/Falls	Skagit Summer/Fall	NC/PS	Summer/Fall
		✔	✔	✔	Puget Sound Natural Summer/Falls	Stillaguamish	NC/PS	Summer/Fall
		✔	✔	✔	Puget Sound Natural Summer/Falls	Snohomish	NC/PS	Summer/Fall
		✔	✔	✔	Puget Sound Natural Summer/Falls	Lake Washington	NC/PS	Summer/Fall
		✔	✔	✔	Puget Sound Natural Summer/Falls	Green	NC/PS	Summer/Fall

-continued-

Table 2.1 Continued.

Presence in Treaty Attachments					Stock Group In Att. I-V	Escapement Indicator	Region	Run
SEAK	NBC/ QCI	WCVI	BC ISBM	SUS ISBM				
✔	✔			✔	Washington Coastal Fall Natural	Hoko	WAC/JDF	Fall
						Quillayute Summer	WAC/JDF	Summer
✔	✔			✔	Washington Coastal Fall Natural	Quillayute Fall	WAC/JDF	Fall
						Hoh Spring/Summer	WAC/JDF	Summer
✔	✔			✔	Washington Coastal Fall Natural	Hoh Fall	WAC/JDF	Fall
						Queets Spring/Summer	WAC/JDF	Summer
✔	✔			✔	Washington Coastal Fall Natural	Queets Fall	WAC/JDF	Fall
						Grays Harbor Spring	WAC/JDF	Spring
✔	✔			✔	Washington Coastal Fall Natural	Grays Harbor Fall	WAC/JDF	Fall
						COLR Upriver Spring	COLR	Spring
✔	✔	✔		✔	Columbia River Upriver Summers	Mid-COLR Summers	COLR	Summer
✔	✔	✔		✔	Columbia River Falls	COLR Upriver Bright	COLR	Fall
✔	✔	✔		✔	Columbia River Falls	Lewis	COLR	Fall
✔	✔	✔		✔	Columbia River Falls	Deschutes	COLR	Fall
✔	✔			✔	Far North Migrating Oregon Coastal	Nehalem	NOC	Fall
✔	✔			✔	Far North Migrating Oregon Coastal	Siletz	NOC	Fall
✔	✔			✔	Far North Migrating Oregon Coastal	Siuslaw	NOC	Fall
						South Umpqua	MOC	Fall
						Coquille	MOC	Fall

[1]The escapement indicator stocks listed in the Annex tables for this group are Upper Fraser, Middle Fraser, and Thompson. The Fraser spring/summer group is split into these 4 escapement indicators to represent the stock group by life history type rather than geographically.

[2]An escapement goal was established for the Cowichan in 2005; a goal for Nanaimo is still pending.

Refer to List of Acronyms for definitions.

2.2 Escapement Goal Assessments

The Agreement directs the CTC to "report annually on the escapement of naturally spawning Chinook salmon stocks in relation to the agreed escapement objectives referred to below, evaluate trends in the status of stocks, and report on progress in rebuilding of naturally spawning Chinook salmon stocks" (Annex IV, Chapter 3, Paragraph 1.b.iii). In this report, escapement assessments include stock specific graphs of escapements and commentary, presented to provide a perspective on stock status and escapement trends through 2011.

The escapement goals and 2009-2011 escapements for the 25 stocks with CTC-accepted escapement goals are listed in Table 2.2. For 12 of these stocks, the agency escapement goal is defined as a range; for the remaining 13 stocks, the escapement goal is defined as a point estimate. In 2011, escapements were within the goal range for 8 stocks, above the range or S_{MSY} point estimate for 12 stocks, and below the goal for five stocks.

The CTC has now assessed the status of stocks with CTC-accepted goals for return years 1999-2011. Over this time period, the number of stocks with CTC-accepted goals has increased from 16 to 25 (Figure 2.1). From 1999-2010, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 46% to 96%. In 2011, the percentage of stocks that met or exceeded goal was 80%. Of the five stocks below goal, two stocks (Blossom and Hoh Spring/Summer) were within 15% of the target goal. Three stocks were more than 15% below goal: Situk, Cowichan, and Queets Spring/Summer.

Table 2.2 Escapement goals, 2009-2011 escapements, and 2012 forecasts for stocks with Chinook Technical Committee agreed goals. Percentages relative to goals are in parentheses. Escapements below the goal or lower bound of the escapement range are shaded; escapements or forecasts below the 85% threshold applicable to Attachment I-III are bold.

Stock	Region	Stock Group	Escapement Goal	2009 Escapement	2010 Escapement	2011 Escapement	2012 Forecast
Situk	**SEAK**	**Yakutat**	**500-1,000**	**902 (180%)**	**167 (33%)**	**240 (48%)**	**500 (100%)**
Chilkat	SEAK	Northern Inside	1,750-3,500	4,429 (253%)	1,852 (106%)	2,803 (160%)	4,900[1]
King Salmon	SEAK	Northern Inside	120-240	109 (91%)	158 (132%)	192 (160%)	NA
Andrew Creek	SEAK	Central Inside	650-1,500	628 (97%)	1,205 (185%)	936 (144%)	NA
Unuk	SEAK	Southern Inside	1,800-3,800	3,157 (175%)	4,290 (238%)	3,272 (182%)	NA
Chickamin (survey index)	SEAK	Southern Inside	450-900	611 (136%)	1,023 (227%)	853 (190%)	NA
Blossom (survey index)	**SEAK**	**Southern Inside**	150-300	**123 (82%)**	**180 (120%)**	**147 (98%)**	**NA**
Keta (survey index)	SEAK	Southern Inside	175-400	219 (125%)	475 (271%)	223 (127%)	NA
Alsek	SEAK/ TBR	TBR	3,500-5,300	6,095 (174%)	9,428 (269%)	6,668 (191%)	NA
Taku	SEAK/ TBR	TBR	19,000-36,000	22,806 (120%)	29,307 (154%)	27,523 (145%)	48,036[2]
Stikine	SEAK/ TBR	TBR	14,000-28,000	11,086 (79%)	15,177 (108%)	14,569 (104%)	40,824[3]
Harrison	BC	Fraser River	75,100-98,500	70,141 (93%)	103,515 (138%)	123,647 (165%)	62,151 (83%)
Cowichan	**BC**	**LGS**	**6,500**	**785 (12%)**	**2,879 (44%)**	**3,492 (54%)**	**NA**
Columbia Upriver Summer	COLR	COLR	12,143[4]	44,295 (365%)	47,228 (389%)	44,432 (366%)	52,350 (431%)
Columbia Upriver Brights	COLR	COLR	40,000	85,759 (214%)	167,007 (418%)	130,395 (326%)	155,320 (388%)[5]
Deschutes River Fall	COLR	COLR	4,532	6,429 (142%)	9,275 (205%)	17,117 (378%)	NA

Lewis	COLR	COLR	5,700	5,410 (95%)	8,701 (153%)	8,009 (141%)	10,323 (181%)
Quillayute Fall	WAC	WAC	3,000	3,130 (104%)	4,635 (155%)	3,993 (133%)	4,010 (134%)
Queets Spr/Sum	**WAC**	**WAC**	**700**	**495 (71%)**	**382 (55%)**	**373 (53%)**	**NA**
Queets Fall	WAC	WAC	2,500	4,156 (166%)	4,022 (161%)	3,928 (157%)	3,283 (131%)
Hoh Spr/Sum	**WAC**	**WAC**	**900**	**880 (98%)**	**828 (92%)**	**827 (92%)**	**NA**
Hoh Fall	WAC	WAC	1,200	2,081 (173%)	2,599 (217%)	1,293 (108%)	1,772 (148%)
Nehalem	ORC	NOC	6,989	5,332 (76%)	5,384 (77)%	7,665 (110%)	8,728 (125%)
Siletz	ORC	NOC	2,944	2,905 (99%)	4,225 (144%)	3,638 (124%)	4,391 (149%)
Siuslaw	ORC	NOC	12,925	14,094 (109%)	22,197 (172%)	30,713 (238%)	24,522 (190%)

[1]The 2012 forecast for Chilkat River Chinook salmon is an inriver run forecast and not a forecast of escapement
[2]The 2012 forecast for Taku River Chinook salmon is a terminal run forecast and not a forecast of escapement
[3]The 2012 forecast for Stikine River Chinook salmon is a terminal run forecast and not a forecast of escapement
[4]The goal of 12,143 is based upon adults counted past Rock Island dam The previously cited goal of 17,857 was obtained by expanding this Rock Island escapement goal for interdam losses between Bonneville and Rock Island dams, as documented in TCCHINOOK (99-3) Those escapements and forecast presented to the right of the goal are the sum of both hatchery and wild adults counted past Rock Island dam Both escapement goals are documented by the CTC in TCCHINOOK (99-3)
[5]Projected escapement in 2012 based on 2009-11 average harvest rate applied to 2012 terminal run forecast

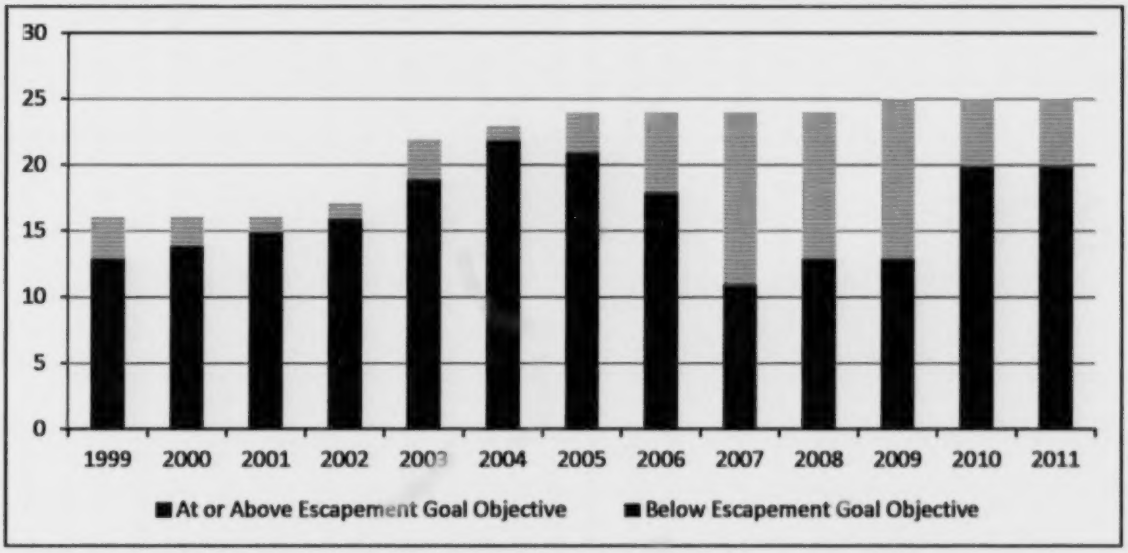

Figure 1.3.2.6.1 Number and status of stocks with Chinook Technical Committee accepted escapement goals for years 1999-2011.

2.3 Paragraph 13 Escapement Analysis

Paragraph 13 of the 2008 Agreement describes a process to implement additional management actions in AABM and ISBM fisheries if the management as prescribed in paragraphs 8 and 10

fail to meet MSY or other biologically-based escapement objectives. Paragraph 13 details a process for evaluating stock groups and indicator stocks listed in Attachments I-II to determine if additional management actions should be implemented in AABM fisheries. If additional management action is required, relevant ISBM fisheries for stocks also listed in Attachments IV and V would commensurately be reduced to increase the escapements of the depressed Chinook salmon stocks within the stock groups triggering the additional management actions. The CTC is to notify the Commission of any proposed fishery restrictions to be implemented under Paragraph 13 at the February Annual Meeting.

Additional management actions for SEAK or NBC AABM fisheries would reduce Table 1 catch limits by 10% if a majority of stocks with agreed management objectives in at least two of the stock groups listed in Attachment I and II of the Chinook salmon Annex were observed:

- at least 15% below their escapement goal management objectives for the past year and are forecast to be at least 15% below their escapement goal objectives in the upcoming year; or

- at least 15% below their escapement goal objectives for the past two consecutive years (unless a forecast for escapement will exceed the escapement objective in the coming year).

If three or more stock groups in Attachments I and II meet the criteria to trigger additional management action, Table 1 catch limits in the relevant AABM fishery would be reduced by 20%. For the WCVI AABM fishery, Attachment III of the 2008 Agreement lists stock groups applicable to the obligations defined in paragraph 13. However, in consideration of the 30% reduction in catch limits for the WCVI AABM fishery, the 2008 Agreement states that additional actions will not be taken for this fishery except as otherwise may be agreed by the Commission.

The 2008 Agreement directs the CTC to provide a review of Attachments I-V by 2014 or earlier, to determine if the current lists of stock groups continue to be appropriate, if there are new criteria that could be employed to revise stock group listings for each attachment, and whether any changes to the Attachments proposed by a Party may be appropriate. In the interim, the CTC in this report provides an evaluation of the stocks listed in Attachments I-III in relation to the criteria described in Paragraph 13.

In Table 2.3, the CTC summarizes the performance of the stock groups and the criteria for initiating additional management action in regards to Paragraph 13, based upon observed escapements and exploitation rates through 2011 and stock forecasts for 2012. For SEAK and NBC AABM fisheries, the stock groups in Attachment I and II are identical, and thus are combined in Table 2.3. All stocks relevant to Paragraph 13 decisions for SEAK and NBC AABM fisheries have escapement based management objectives. Although not meeting management objectives does not automatically trigger reductions in the WCVI AABM fishery, the CTC included an evaluation of the stock groups in Attachment III to inform the Commission of the performance of the stock groups in Attachment III in relation to the provisions of Paragraph 13. For the WCVI AABM fishery, stocks in the Puget Sound Summer/Fall stock

group include three stocks with exploitation rate management objectives which have yet to be submitted for CTC review.

Table 2.3 Evaluation of criteria for initiating additional management action in regards to Paragraph 13 of the Chinook salmon Chapter of the Pacific Salmon Treaty 2008 Agreement. When the stock group cannot be evaluated because an insufficient number of stocks in the group have agreed escapement objectives, or that forecasts were not provided to the Chinook Technical Committee for stocks with agreed escapement objectives, NA is shown.

Fishery	Stock Group	Stocks	Stocks with agreed objective	Number below threshold (2010 and 2011)	Stocks with a 2012 forecast	Number of 2012 forecasts below threshold	Paragraph 13 criteria met
SEAK/ NBC	North/Central British Columbia	3	0	NA	0	NA	No
	Upper Strait of Georgia	5	0	NA	0	NA	No
	West Coast Vancouver Island Falls	7	0	NA	0	NA	No
	Far North Migrating Oregon Coastal Falls	3	3	0	3	0	No
	Columbia River Falls	3	3	0	2	0	No
	Columbia River Summers	1	1	0	1	0	No
	Washington Coastal Fall Naturals	5	3	0	3	0	No
	Fraser Early (Spring & Summers)	3	0	NA	0	NA	No
WCVI	Columbia River Falls	3	3	0	2	0	No
	Fraser Late	1	1	0	1	1	No
	Puget Sound Natural Summer/Falls	5	0	NA	0	NA	No
	Columbia River Summers	1	1	0	0	0	No

No stock groups listed in Attachment I-III met the criteria for triggering additional management action under Paragraph 13 for either the 2010 and 2011 observed values or the 2011 observed and 2012 forecast values (Table 2.3). No stocks in the Attachment I-III stock groups with an agreed escapement objective were more than 15% below the management objective in both 2010 and 2011.

Only five of the 10 different stock groups in Table 2.3 have stocks with agreed management objectives that can be evaluated for triggering additional management action. These five stock groups contain 13 stocks, of which 11 have agreed escapement objectives. Of the 11 stocks, forecasts for 2012 were available for nine (Table 2.3). The CTC has identified a need to develop management objectives and forecast capabilities for more of the stocks and stock groups included in Attachments I-III to improve the efficacy of the Paragraph 13.

As stated previously, the CTC is to notify the Commission of any proposed fishery restrictions to be implemented under Paragraph 13 at the February Annual Meeting, however, due to the lack of escapement data for 2011 and forecasts for 2012, the paragraph 13 escapement analysis was not completed until well after the February due date. Much of the data were not available until April. Also, the CTC has not yet set the standards for precision and accuracy for forecasts and predictions used to develop Table 2.3. These data standards will be required before the evaluations that rely on forecasts can be used to recommend additional management action. However, the CTC has carried out the evaluation of the Paragraph 13 criteria, with the exception 13(d) and (e), to provide insight into current status of stocks in relation to the criteria and to identify data needs for the application of Paragraph 13. To meet the timing requirement for implementation of Paragraph 13, the CTC would need before the February Annual Meeting: a) escapement and exploitation rate estimates for the prior year for stocks included in Paragraph 13 Attachments I-V; and b) projections of exploitation rates and forecasts of escapements for the coming year for these same stocks.

As noted above, the Commission has assigned the CTC to review Attachments I-V and to provide recommendations on their use to the Commission. In its review, the CTC will consider the schedule of needed information for evaluation of the stock group criteria to determine how early in the annual cycle recommendations for additional management actions under Paragraph 13 can be provided to the Commission.

2.4 Trends and Profiles for Escapement Indicator Stocks

Graphs of time series of escapements for Chinook salmon stocks are included in sections for Alaska, Canada, Puget Sound, Coastal Washington, Columbia River, and Oregon Coast. For each stock, there is a commentary describing the escapement methodology, escapement goal basis, escapement evaluation and agency comments. Escapement is usually reported in adults by calendar year. All escapement goals accepted by the CTC are shown. Historical escapement and terminal run data are provided in the appendices for SEAK stocks (Appendix B.1), Canadian stocks (Appendix B.2), Puget Sound (Appendix B.3), Washington Coastal stocks (Appendix B.4), Columbia River stocks (Appendix B.5) and Oregon Coastal stocks (Appendix B.6).

2.4.1 Southeast Alaska and Transboundary River Stocks

Of the 11 SEAK and TBR stocks included in the escapement assessment, the Situk, Chilkat, Taku, King Salmon, Stikine, and Unuk Rivers and Andrew Creek include estimates of total escapement of large fish, Chinook salmon $\geq$ 660 mm mid-eye to tail fork (MEF) length. In most systems these include 3-, 4-, and 5-ocean age fish and include almost all females and large males in the stocks; 1- and 2- ocean age males are not included in these estimates except those fish > 659 mm MEF. Escapement estimates for the Chickamin, Blossom, and Keta Rivers are index counts of large fish. These indices are enumerated from aerial helicopter surveys that represent a fraction (one-third to one-fifth) of the total number of large spawners. Except for the Chilkat River, survey methods have been standardized for all systems since 1975. The assessment of Chilkat River Chinook salmon was standardized in 1991 as an annual mark-recapture (MR) estimate of escapement. Escapement goals have been defined as a range for the SEAK/TBR

stocks. Escapement estimates for the Alsek River are estimates of total escapement of age-1.2 fish and older.

The SEAK and TBR stocks can be classified into two broad categories, inside-rearing and outside-rearing, based on ocean migrations. Outside-rearing stocks have limited marine rearing in SEAK and are caught primarily during their return spawning migrations in the spring; these stocks include Chinook salmon returning to the Situk, Alsek, Taku, and Stikine Rivers. Inside-rearing stocks are vulnerable to SEAK and NBC fisheries as immature fish as well as during their spawning migrations and include the other seven SEAK indicator stocks. Note that there is some overlap in these stocks within these two broad classifications. All SEAK and TBR indicator stocks produce primarily yearling smolt except the Situk River, which presently produces primarily sub-yearling smolt. Sub-yearling smolts comprise about 10% of the annual runs in the Keta and Blossom Rivers.

The Alaska Department of Fish and game (ADF&G) established a 15-year rebuilding program in 1981 (ADF&G 1981). ADF&G established interim point escapement goals in 1981 for all 11 systems, based on the highest observed escapement count prior to 1981. ADF&G and CDFO for three TBR stocks have subsequently revised escapement goals that have been reviewed and accepted by the CTC for all eleven stocks, some more than once. ADF&G uses escapement goal ranges in conformance with the ADF&G Salmon Escapement Goal Policy and Sustainable Salmon Fisheries Policy.

Revised escapement goals for the Blossom and Keta Rivers were reviewed and adopted by the CTC in June 2011. Updated statistical and modeling techniques were used to incorporate a decade of new and improved information on each system and analyses underwent rigorous review by ADF&G and the CTC.

2.4.1.1 Southeast Alaska Stocks

2.4.1.1.1 Situk River

The Situk River is a non-glacial system located near Yakutat, Alaska, that supports a moderate-sized, outside-rearing stock of Chinook salmon. Few Situk-origin Chinook salmon are caught in PSC fisheries other than in directed sport, commercial and subsistence fisheries located both inside the river and inlet and in nearby surf waters. The fisheries that target this stock fall under a management plan to achieve escapements within the range.

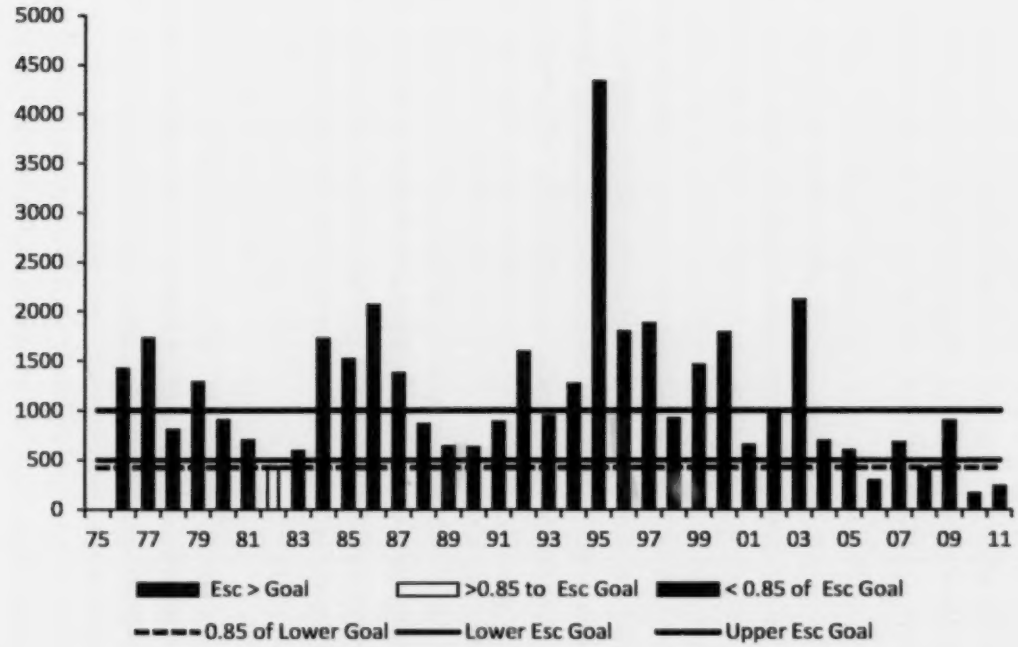

Figure 2.4.1.1.1 Situk River escapements of Chinook salmon from 1976 to 2011.

Escapement Methodology: Escapements are based on weir counts minus upstream sport fishery harvests (if any), which are estimated from an on-site creel survey and a post season mail-out survey. The weir has been operated annually since 1976, and was also operated from 1928-1955. Counts of large Chinook salmon are reported as the spawning stock. Jacks (1- and 2-ocean-age fish) are also counted and, since 1989, jack counts (not included in the graph above) have ranged between 1,200 and 4,000 fish.

Escapement Goal Basis: In 1991, ADF&G revised the Situk River Chinook salmon escapement goal to 600 large spawners based upon a spawner-recruit analysis (McPherson 1991), which was reviewed and adopted by the CTC. In 1997, ADF&G revised the Situk River escapement goal range to 500-1,000 large spawners to conform to the department's escapement goal policy. The CTC reviewed and accepted this change in 1998. ADF&G changed the goal range to 450-1,050 large spawners in 2003; this range was reviewed by the CTC in 2004 but not accepted.

Escapement Evaluation: The Situk River stock is healthy with annual escapements being less than 85% of the goal only three times since 1976 yet all three instances have occurred within the past four years (2008, 2010 and 2011).

Agency Comments: Total annual terminal harvest rates for all gear groups combined have averaged about 60% from 1990-2003. Harvest rates have been lower since 2004 as this stock has experienced poor survival for recent brood years and terminal fisheries were curtailed as a result. In 2010 and 2011, the escapements were 167 and 240 large Chinook salmon, 33% and 48% of the lower end of the escapement goal range, respectively. However, in 2010 the weir was out for

a 3-day period and an undetermined number of spawners were not counted yet sport and commercial fisheries were restricted to non-retention of Chinook salmon in 2010 and 2011.

2.4.1.1.2 Chilkat River

The Chilkat River is a moderate-sized glacial system located near Haines, Alaska which supports a moderate-sized, inside-rearing stock of Chinook salmon. Smolts from this stock have had CWTs applied at relatively high rates (8-10%) beginning with the 1999 brood year; additional wild-stock tagging occurred for 3 broods prior to that time. Relatively small terminal U.S. marine sport and subsistence fisheries target this stock. This stock is also caught incidentally in sport, commercial drift gillnet and troll fisheries in northern SEAK.

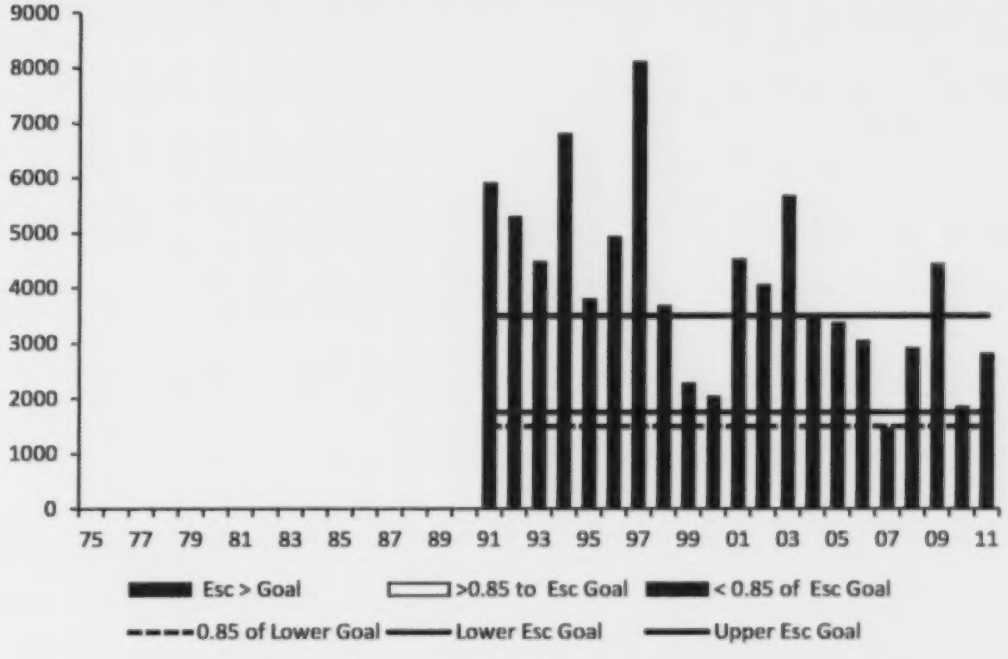

Figure 2.4.1.1.2Chilkat River escapements of Chinook salmon from 1991 to 2011.

Escapement Methodology: Escapements are based on estimates of large spawners from a MR program annually since 1991 (Ericksen and McPherson 2003). The escapement data are relatively precise with coefficients of variation for annual escapements averaging 15% since 1991. From 1975-1992, aerial survey counts were conducted on two small tributaries with relatively clear water; results from these estimates were inconsistent. Radio telemetry studies conducted in 1991 and 1992 found that spawners in these two tributaries represented less than 5% of the total escapement, and did not represent trends in abundance and the aerial surveys were discontinued.

Escapement Goal Basis: The 1981 escapement goal was set at 2,000 large fish, based on an assumed fraction of the total escapement represented by discontinued survey counts. In 2003 (Ericksen and McPherson 2003) recommended a revised escapement goal range of 1,750 to

3,500 large Chinook salmon spawners, based on the MR estimates of escapement and limited CWT information available for this stock. This goal range was reviewed and adopted by ADF&G and the Alaska Board of Fish in 2003 and subsequently reviewed and accepted by the CTC.

Escapement Evaluation: The Chilkat River stock is healthy with annual escapements being at least 85% of the goal in all years except in 2007.

Agency Comments: Available CWT information on this stock suggests that exploitation is about 20% for recent brood years from the CTC exploitation rate analysis. Escapements since 1991 have been within or above the escapement goal range in all years except 2007. The preliminary escapement in 2011 was estimated at 2,803 large spawners, near the mid-point of the escapement goal range.

2.4.1.1.3 King Salmon River

The King Salmon River is a small non-glacial system located on Admiralty Island southeast of Juneau that supports a small, inside-rearing stock. Few Chinook salmon originating in the King Salmon River are caught in PSC fisheries and there is no terminal fishery targeting this stock. However, harvests of immature and mature fish do occur in SEAK fisheries.

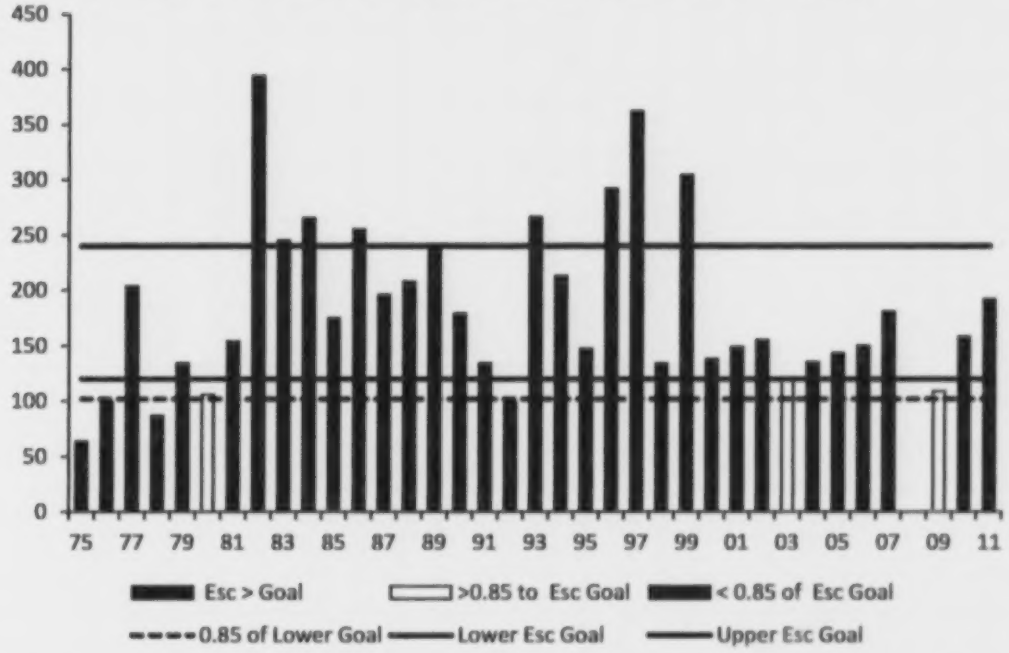

Figure 2.4.1.1.3King Salmon River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Escapements of large Chinook salmon are based upon weir counts from 1983-1992 and expansions of survey counts from 1971 to 1982 and 1993 to 2011, to make estimates equivalent to weir counts. A weir was operated for 10 years (1983-1992) along with the surveys and, on average the total escapement was 1.52 times the survey count (McPherson

and Clark 2001). Jacks (2-ocean-age fish) represented an average of 22% of the weir counts from 1983-1992 and are not included in the graph above.

Escapement Goal Basis: In 1981, ADF&G set the index goal at 200 large fish based upon peak survey counts of 200 spawners in 1957 and 211 spawners in 1973. In 1997, ADF&G revised the goal to 120-240 total large fish based upon a spawner-recruit analysis for the 1971-1991 brood years (McPherson and Clark 2001). The analysis and goal range was accepted by the CTC in 2001.

Escapement Evaluation: The King Salmon River stock is healthy with annual escapements being less than 85% of the goal only four times since 1976 and three of those instances occurred in the mid to late 1970s and the other was in 1992.

Agency Comments: There is no terminal fishery targeting this stock and escapements have been within or above the accepted range in recent years. The estimated escapement in 2011 was 192 large spawners, near the mid-point of the escapement goal range. Survey conditions in 2011 were complicated by poor weather thus limiting the number of surveys.

2.4.1.1.4 Andrew Creek

Andrew Creek, near Petersburg, Alaska, is a small non-glacial U. S. tributary of the lower Stikine River that supports a moderate run of inside-rearing Chinook salmon. Before 1976, a large terminal marine gillnet fishery occurred in the spring, targeting Stikine River and other nearby Chinook salmon stocks. Harvests of immature and mature Andrew Creek fish occur primarily in SEAK and to a small extent in NBC fisheries, based on CWT recoveries of Chinook salmon from SEAK hatcheries using Andrew Creek brood stock.

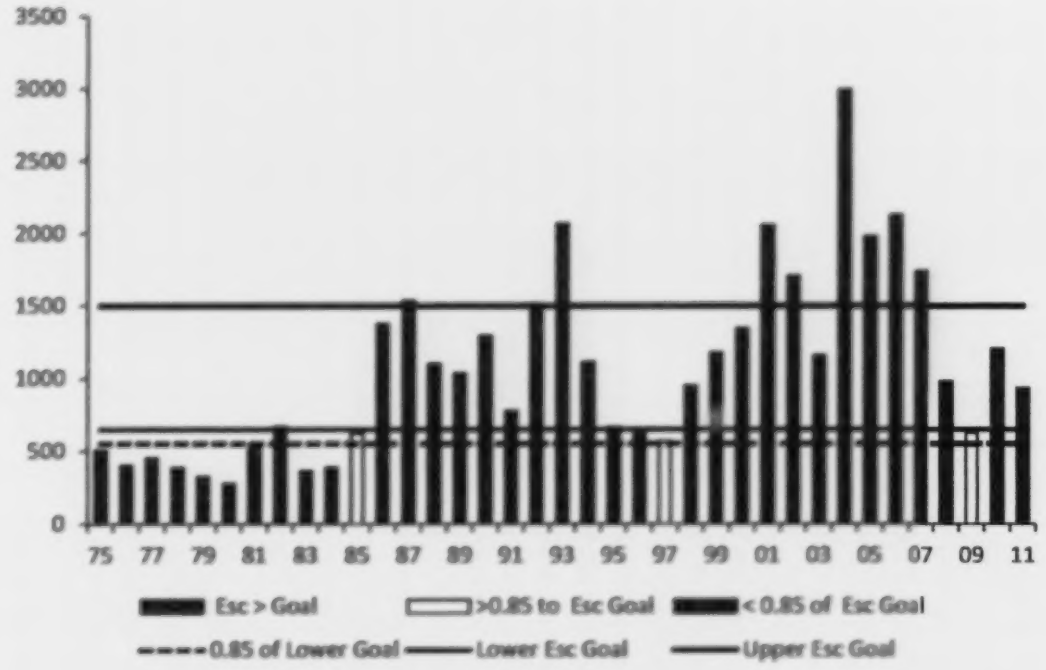

Figure 2.4.1.1.4 Andrew Creek escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Escapements are based upon weir counts from 1976 to 1984 and expansions of index counts in 1975 and from 1985 to 2011. Four years of concurrent weir and index count data were used to estimate the expansion factor of 1.95. Jacks have represented an average of 19% of the weir counts and are excluded in the figure above.

Escapement Goal Basis: In the early 1980s, ADF&G set the Andrew Creek Chinook salmon escapement goal at 750 large fish (total escapement). In 1997, an initial stock-recruit analysis was developed that underwent review by ADF&G and the CTC. This analysis was completed in 1998 and the technical report (Clark et al. 1998) recommended a revised biological escapement goal range of 650 to 1,500 large Chinook salmon that was accepted and adopted by the ADF&G and the CTC.

Escapement Evaluation: The Andrew Creek stock is healthy with annual escapements being less than 85% of the goal nine times since 1975; however, all of those instances occurred prior to 1985.

Agency Comments: Before 1976 a large terminal marine gillnet fishery occurred in the spring, targeting Stikine River and other nearby Chinook salmon stocks. Starting in 2005, during years of surplus production to the Stikine River, directed Chinook salmon fisheries were allowed in the marine waters in District 108 near Petersburg and Wrangell. Directed fisheries were allowed between 2005 and 2009 and in 2011, that included commercial gillnet and troll fisheries as well as liberalized sport regulations. In some of these years the surplus production was too small to

prosecute commercial fisheries; however, the sport fisheries were liberalized. The implementation of the new directed fisheries has resulted in increased harvest rates of Andrew Creek Chinook salmon. Nevertheless, escapements since 2005 have been within or above the escapement goal range each year with the exception of 2009, which was within 85% of the lower bound of the escapement goal range. The estimated escapement in 2011 was 936 large spawners, near the mid-point of the escapement goal range.

2.4.1.1.5 Unuk River

The Unuk River is a moderate-sized glacial system that supports a moderate run of inside-rearing Chinook salmon. Escapements are estimates of total escapement of large spawners. Harvests of immature and mature fish occur in SEAK and NBC fisheries. On average, for the 1992-2001 broods, harvest by gear sector was 47% SEAK troll, 36% SEAK sport, 10% SEAK net and most of the remainder caught in NBC. About 55% of the harvest is taken in the southern inside area of SEAK (mostly troll and sport). Estimated annual harvest rates averaged about 27% in nominal numbers and 24% in AEQs from 1985 to 1998 (Hendrich et al. 2008). Coded-wire tagging of this stock was conducted for the 1982–1986 (Pahlke 1995) and the 1992–present broods; this stock is now an exploitation rate indicator stock.

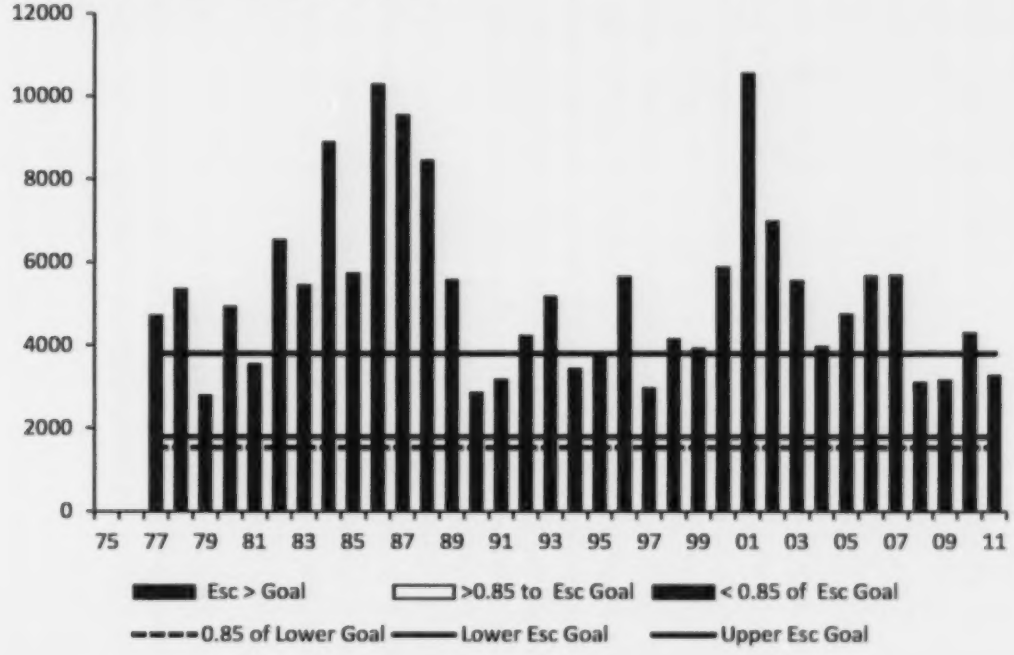

Figure 2.4.1.1.5 Unuk River escapements of Chinook salmon from 1977 to 2011.

Escapement Methodology: Escapements of large spawners are MR estimates from total escapements from 1997 to 2011 and expanded survey counts from 1977 to 1996. Radio telemetry studies in 1994 and 2007 showed that the surveys are conducted in stream reaches where 80% of the spawning occurs; the expansion factor for survey counts is 4.83 (Hendrich et al. 2008).

Escapement Goal Basis: In 1994, ADF&G revised the Unuk escapement goal to 875 large spawners in survey (index) counts, based upon the spawner-recruit analysis reported by McPherson and Carlile (1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the goal to a range of 650-1,400 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998. Since the expansion factor for surveys was unknown at that time, the goal was expressed in survey count currency. In 2008, a more extensive analysis was done with spawners, recruitment and fishing mortality expressed in total numbers of fish because of the extensive number of MR estimates of escapement and CWT data available (Hendrich et al. 2008). The analysis included the 1982-2001 brood years. The CTC-accepted a range of 1,800 to 3,800 large spawners, with a point estimate of 2,764, in 2009.

Escapement Evaluation: The Unuk River stock is healthy with annual escapements since 1977 within or above the escapement goal range in all years.

Agency Comments: In the 35 years since 1977, the estimated escapements have been within or above the escapement goal range each year. In 2011, the MR program estimated escapement of 3,272 large spawners.

2.4.1.1.6 Chickamin River

The Chickamin River is a moderate-sized glacial system that supports a moderate run of inside-rearing Chinook salmon, based on wild-stock CWTs. There is no terminal fishery targeting this stock; harvests of immature and mature fish occur in marine SEAK and NBC fisheries, with the majority of harvests taken in the southern inside quadrant of SEAK by troll and sport gear sectors. There is no subsistence or freshwater fisheries on any Behm Canal Chinook salmon stocks. Coded-wire tagging on the Chickamin River was conducted for the 1982-1986 broods (Pahlke 1995) and resumed for the 2000-2006 broods. Total exploitation rates for recent broods were about 28-30% in AEQs under the current management regime.

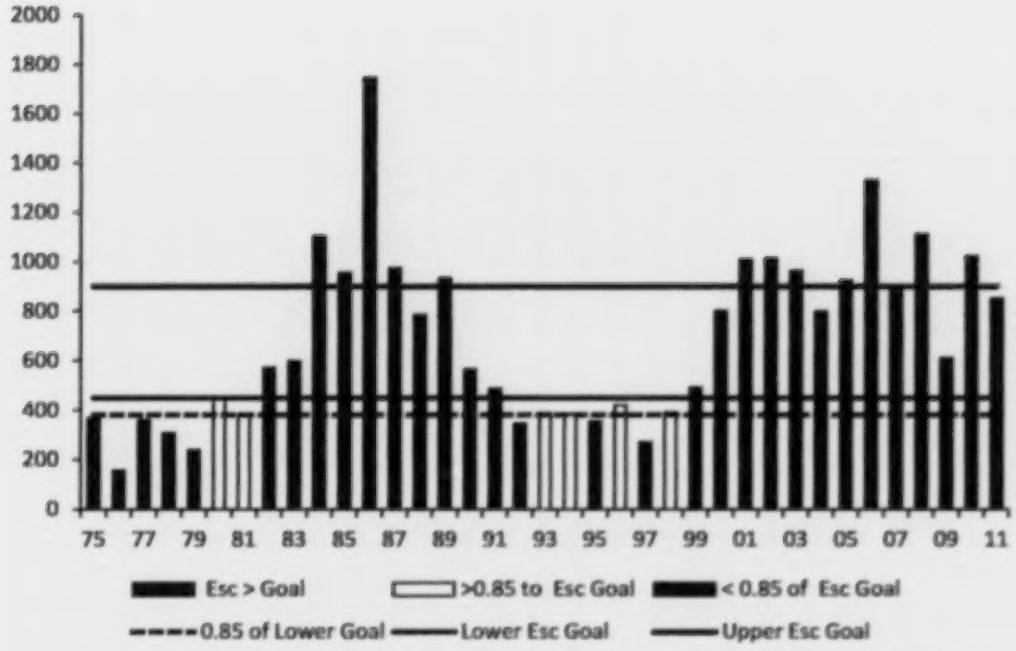

Figure 2.4.1.1.6 Chickamin River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: The escapements shown above are survey counts (unexpanded highest single-day counts) of large fish in eight tributaries of the Chickamin River using standardized methodology (Pahlke 2003). MR studies in 1995, 1996 and 2001-2005 found that about 21% of the total escapement is counted during peak surveys on average (Weller et al. 2007). A radio telemetry study in 1996 indicated that the annual surveys are conducted in stream reaches where over 80% of all spawning occurs. The expansion factor is estimated at 4.75 for survey counts using the results from the 1996 and 2001-2005 studies.

Escapement Goal Basis: In 1994, ADF&G revised the goal to 525 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to 450-900 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy (ADF&G 1997). The CTC reviewed and accepted this change in 1998.

Escapement Evaluation: The Chickamin River stock is currently healthy with annual escapements being less than 85% of the goal only eight times since 1975, all of which occurred before 1999.

Agency Comments: Like the nearby Blossom and Keta Rivers, this stock produces the largest Chinook salmon in SEAK. The time series of survey counts follows 2 cycles: counts for 1975-1981 and 1992-1998 were below the goal range, and those from 1982-1991 and 1999-2010 were all within or slightly above the range. Survey counts since 1999 have averaged 953 large

spawners. In 2011, the survey count was 853 which is near the upper end of the escapement goal range and represents an estimated total escapement of 4,052 large spawners.

2.4.1.1.7 Blossom River

The Blossom River is a small-sized non-glacial system that supports a small run of inside-rearing Chinook salmon and empties into Behm Canal near Ketchikan. There is no terminal fishery targeting this stock; harvests of immature and mature fish occur in SEAK and NBC fisheries, based on wild-stock and hatchery-stock data from the nearby Unuk and Chickamin River. All waters of east Behm Canal are closed to Chinook salmon fishing year round. Age data collected since 1998 indicate that about 10% of the annual run had under-yearling smolt life history.

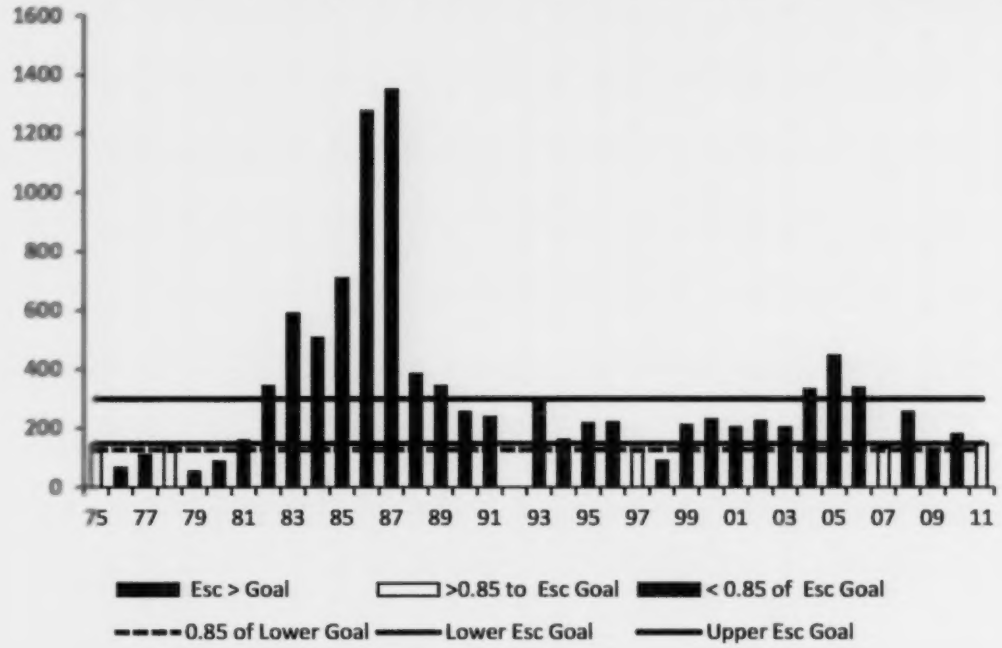

Figure 2.4.1.1.7Blossom River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Indices of escapement are peak single-day survey counts of large spawners that have been standardized in area and time since 1975 (Pahlke 2003). Studies using MR were performed in 1998 and in 2004 to 2006 in addition to the survey counts. The agency agreed expansion factor is 3.87 for years without MR estimates.

Escapement Goal Basis: In 1994, ADF&G revised the Blossom goal to 300 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to a range of 250-500 large index spawners in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998. In 2010, the ADF&G submitted a report to the CTC with a revised goal of 150-300 large index spawners. The CTC accepted the revision in June 2011.

Escapement Evaluation: The Blossom River stock is healthy with annual escapements being less than 85% of the goal only six times since 1975.

Agency Comments: Between 1976 and 1980, survey counts were below the current escapement goal, averaging 93 large fish. These smaller escapements subsequently seeded large runs with resultant large escapements during the six-year period of 1982-1987, with counts averaging 796 fish. This six-year period of larger escapements has been followed by a 24-year period (1988-2011) of reduced, but relatively stable, spawning abundance averaging 230 large fish in survey counts. The 2011 survey count of 147 large spawners was just below the escapement goal range; however, survey counting conditions were poor and only one survey was conducted in 2011 which was felt to be a minimal estimate of the peak survey abundance.

2.4.1.1.8 Keta River

The Keta River is a small-sized non-glacial system southeast of Ketchikan that supports a small run of inside-rearing Chinook salmon. There is no terminal fishery targeting this stock; harvests of immature and mature fish occur in SEAK and NBC fisheries, based on wild-stock and hatchery-stock data from the nearby Unuk and Chickamin River. All waters of east Behm Canal are closed to Chinook salmon fishing year round. Age data collected since 1998 indicate that about 10% of the annual run had under-yearling smolt life history.

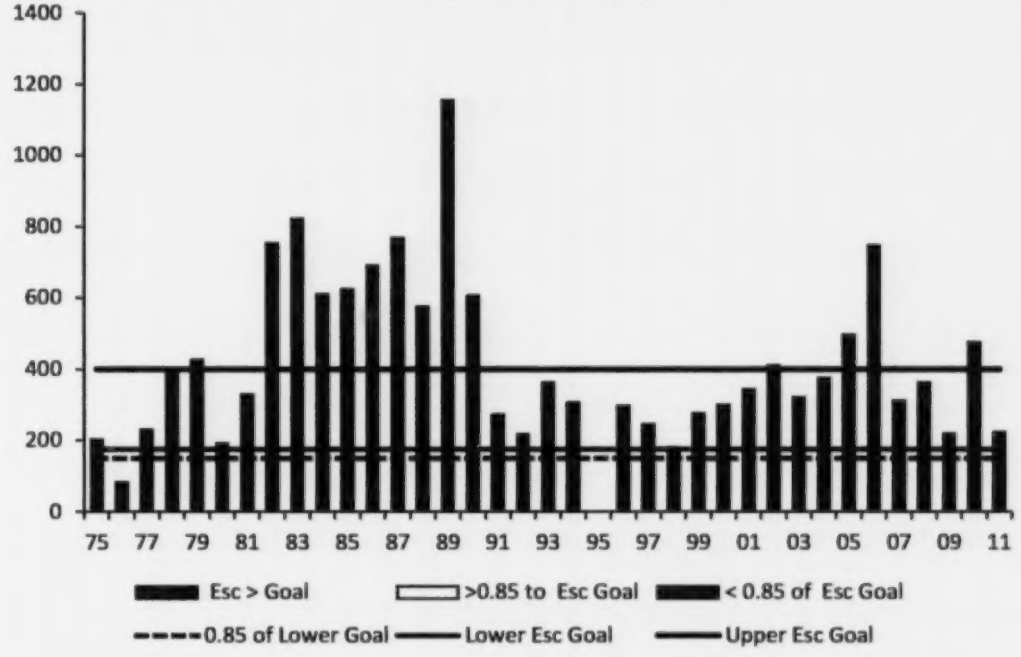

Figure 2.4.1.1.8 Keta River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Indices of escapement are peak single-day survey counts of large spawners, that have been standardized in area and time since 1975 (Pahlke 2003). Total

escapement was estimated with MR methodology in 1998, 1999, and 2000 (Freeman et al. 2001). The estimated expansion factor for survey counts is 3.01.

Escapement Goal Basis: In 1994, ADF&G revised the escapement goal to 300 large index spawners based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the escapement goal to a range of 250-500 large index spawners in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy (ADF&G 1997). The CTC reviewed and accepted this change in 1998. In 2010, ADF&G submitted a report to the CTC with a revised goal of 175-400 large index spawners. The CTC accepted the revision in June 2011.

Escapement Evaluation: The Keta River stock is healthy with annual escapements being less than 85% of the goal only one time since 1975.

Agency Comments: Like the nearby Blossom River, survey counts were low in the 1970s, rose in the mid to late 1980s and have been relatively stable since that time. Between 1975 and 1981, annual survey counts were within or below the goal of 250-500, averaging 265 large spawners. Production from the 1975-1981 escapements was high and survey counts from 1982 to 1990 averaged 734 large fish. This was followed by a 21-year period (1991-2011) of relatively stable survey counts, averaging 327 large spawners. The survey count in 2011 was 223 large spawners but survey counting conditions were poor and only one survey was conducted in 2011 which was felt to be a minimal estimate of the peak survey abundance.

2.4.1.2 Transboundary River Stocks

2.4.1.2.1 Alsek River Chinook Salmon

The Alsek River is large transboundary glacial system that originates in the SW Yukon Territory and NW British Columbia and flows into the Gulf of Alaska about 50 miles east of Yakutat. This river supports a moderate run of outside-rearing Chinook salmon.

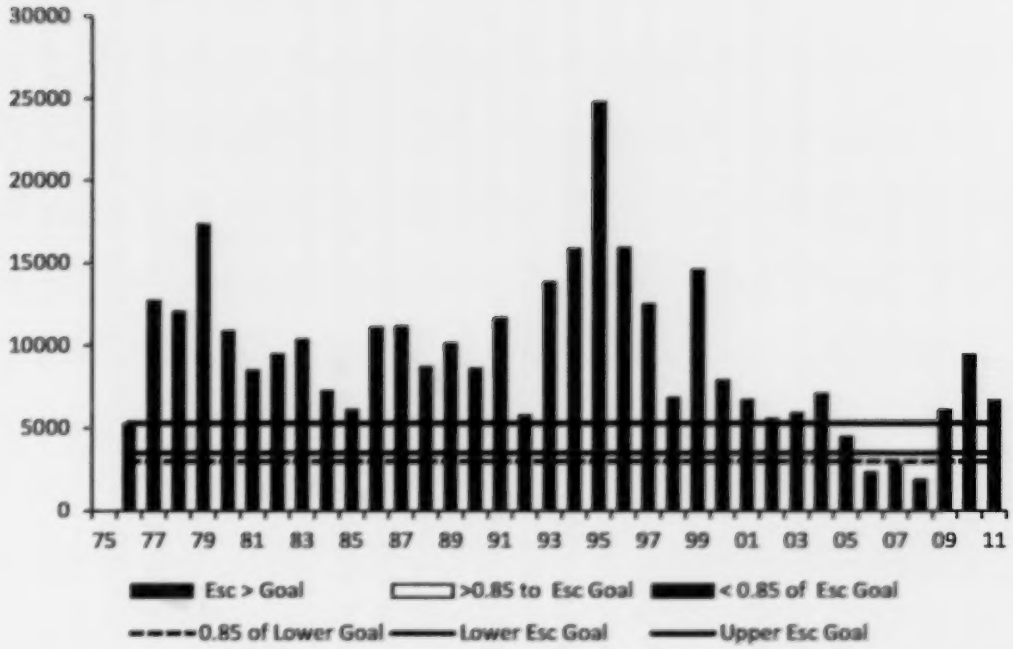

Figure 2.4.1.2.1 Alsek River escapements of Chinook salmon from 1976 to 2011.

Escapement Methodology: Since 1976 escapements have been principally monitored by a weir operated at the Klukshu River, one of 51 tributaries of the Tatshenshini River, the principal salmon-producing branch of the Alsek River. Index escapements were estimated using a weir at the Klukshu River. These have been replaced with estimates of total escapement, drainage-wide, including direct MR estimates for 1998-2004. All other years are Klukshu River weir counts expanded by the average expansion factor (4.00) from 1998-2004.

Escapement Goal Basis: During this cycle, a revised goal of 3,500 to 5,300 total spawners (fish age-1.2 and older) was accepted by the CTC, ADF&G, and Canadian Science Advisory Pacific, based on analysis in Bernard and Jones (2010). Prior to this, the goal was based on the escapement counted through the Klukshu River weir (McPherson et al. 1998).

Escapement Evaluation: The Alsek River stock is healthy with annual escapements being less than 85% of the goal only three times since 1976. These poor escapements just recently occurred (2006, 2007 and 2008); however, since that time, escapements have been above the upper bound of the escapement goal range.

Agency Comments: Directed Canadian sport and aboriginal fisheries occur in various upriver sections of the Alsek River. Some Chinook salmon are caught as by-catch in the U.S. sockeye directed fishery that takes place inriver near the estuary and within the estuary. A few Chinook salmon are also caught in a U.S. subsistence fishery that takes place in the same area as the U.S. sockeye fishery. Total annual harvest rates have averaged 12% since 1976 (Bernard and Jones 2010). Escapements in the Alsek River have averaged 9,500 Chinook salmon over the 35-year

period of 1976-2010. The 2011 escapement was 6,668 Chinook salmon based on the Klukshu weir count of 1,667 expanded by a factor of 4.0. The joint ADF&G-CDFO assessment is that the Alsek River stock is healthy but underutilized.

2.4.1.2.2 Taku River Chinook Salmon

The Taku River is a large Transboundary glacial system that supports a large run of outside-rearing Chinook salmon. Few Taku origin Chinook salmon are caught in PSC fisheries other than in terminal areas including District 11 of Southeast Alaska and in the Canadian portion of the lower river itself. Directed gillnet fisheries by both Parties to the Agreement take place in terminal areas in years when abundance exceeds predetermined levels as described in the Agreement under Chapter One, Transboundary Rivers 3(b)(3). In other years, Taku origin Chinook salmon are caught as by-catch in directed gillnet fisheries for sockeye salmon in terminal waters (District 11 of Southeast Alaska and in-river in Canada), in sport fisheries near Juneau Alaska, and in inriver First Nation fisheries in Canada.

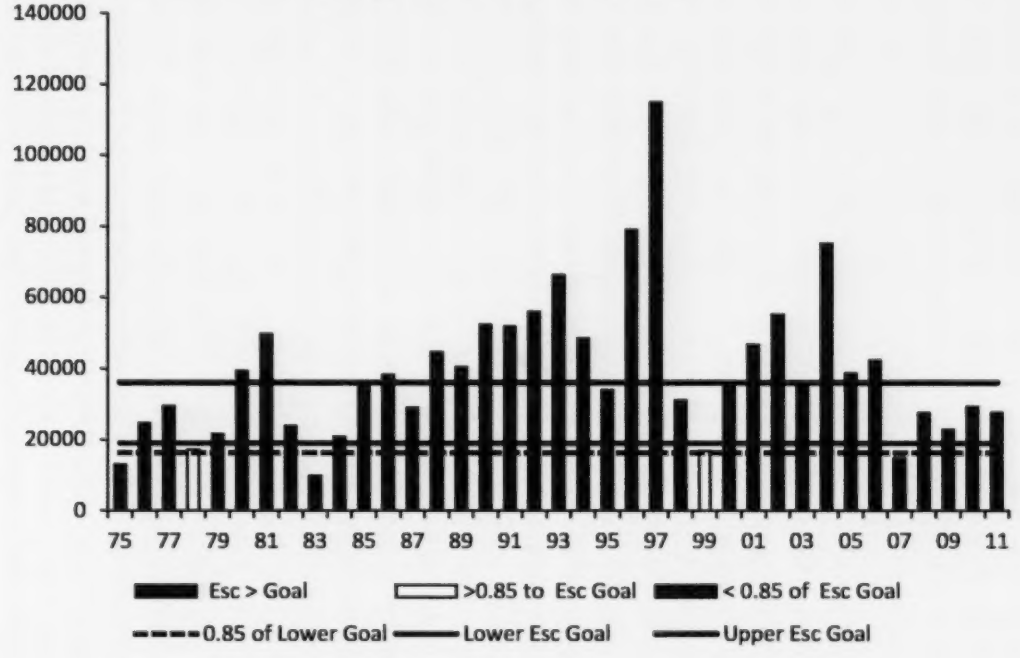

Figure 2.4.1.2.2Taku River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Total escapements of large fish (> 659 mm mid-eye to fork of tail length) were estimated with mark-recapture experiments in 1989, 1990, and 1995-present. The MR estimates are unbiased and have an average CV of 15%. Aerial survey counts in other years were expanded by a factor of 5.2, which is the average of the ratio of the mark-recapture estimates to aerial survey counts. Aerial survey methods for stock assessment were standardized in 1975. Estimates of escapement based upon expanded aerial survey counts are assumed unbiased and have a CV of about 25%.

Escapement Goal Basis: Prior to 1999, several system-wide or index goals were developed by the U.S. and Canada based upon limited data. A goal based upon maximizing smolt production was in place from 1999-2009. In 2009, an escapement goal of 19,000 to 36,000 large Chinook salmon based upon stock-recruit analysis (McPherson et al. 2010) was accepted by the CTC.

Escapement Evaluation: The Taku River stock is healthy with annual escapements being less than 85% of the goal only three times since 1975 (1975, 1983, and 2007). Exploitation rates on the stock have never exceeded the MSY exploitation rate level.

Agency Comments: The Taku River is both an escapement indicator stock and an exploitation rate indicator stock. Wild smolts have been marked with CWTs (1976-1981 and 1993-present), and CWT recoveries from fisheries and escapements are used to estimate exploitation rates and production. Historically, a significant terminal marine gillnet fishery occurred, but stock assessment was not adequate for management. In 2005, the Parties developed an abundance based management regime for Taku River origin Chinook salmon with harvest sharing. The abundance based management regime includes preseason forecasts, inseason run projections, and post season assessments which when coupled with carefully controlled weekly openings of gillnet fisheries on both sides of the border has allowed sustained harvest while ensuring escapement needs are not jeopardized by fishing. The 2011 escapement was 27,523 Chinook salmon based on the results of the mark-recapture experiment, well above the lower bound of the escapement goal range and the joint ADF&G-CDFO assessment is that the stock is healthy.

2.4.1.2.3 Stikine River Chinook Salmon

The Stikine River originates in British Columbia and flows into central Southeast Alaska near the towns of Petersburg and Wrangell. This is the largest river emptying into SEAK, glacial in origin, and supports a large, outside-rearing stock of Chinook salmon. Starting in 2005, during years of surplus production to the Stikine River, directed Chinook salmon fisheries were allowed in the marine waters in District 108 near Petersburg and Wrangell. Since that time, directed fisheries have occurred in all but one year.

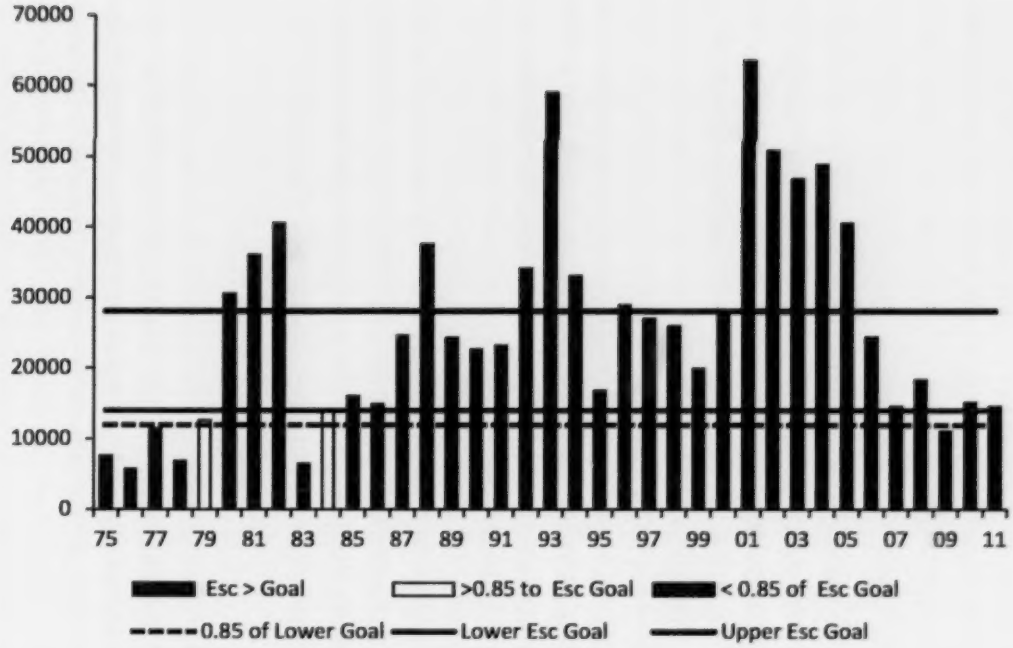

Figure 2.4.1.2.3 Stikine River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: From 1975 through 1984, index escapements were made using survey counts and since 1985 counts were made using a weir at the Little Tahltan River. Since 1996 MR experiments were conducted annually to estimate total escapement. These studies indicate the weir counts represented 17% to 20% of the total escapement (Pahlke and Etherton 1999).

Escapement Goal Basis: An escapement goal of 14,000 to 28,000 large Chinook salmon (age-.3 to -.5 fish) was established in 1999 after review and acceptance by the CTC, ADF&G, TBR Panel, and Canadian Science Advisory Pacific, based on the analysis in Bernard et al. (2000). Previously, several system-wide or index goals were developed by the U.S. and Canada, and were based on limited data.

Escapement Evaluation: The Stikine River stock is healthy with annual escapements being less than 85% of the goal only six times since 1975; however, this has only occurred once in the past 28 yrs (2009).

Agency Comments: In recent years of directed Chinook salmon fishing, total harvest rates on Stikine River Chinook salmon are believed to have ranged between 50% and 70%. Most harvests occur in the U.S. commercial gillnet and sport fisheries in District 108 near Petersburg and Wrangell and inriver in the Canadian gillnet and aboriginal fisheries. CDFO and ADF&G currently operate joint programs to CWT smolt in order to estimate smolt and adult production, as well as exploitation. Since 1985, escapements to the Stikine River were within or above the escapement goal range except in 2009. In 2011, an estimated 14,569 large fish escaped into the Stikine River and the joint ADF&G-CDFO assessment is that the stock is healthy.

2.4.2 Canadian Stocks

Since the beginning of the Chinook salmon rebuilding program of the 1985 PST, escapement goals for Canadian Chinook salmon stocks were generally based on doubling the average escapements recorded from 1979-1982. The doubling was based on the premise that Canadian Chinook salmon stocks were over-fished and that doubling the escapement would still be less than the optimal escapement estimated for the aggregate of all Canadian Chinook salmon populations (see stock-recruitment curve in "Technical Basis of PSC Catch Ceilings," Figure 1, Attachment 4, PSC file 72006; PSC Office, Vancouver, BC). Doubling was also expected to be a large enough change in escapements to allow detection of the change in numbers of spawners and the subsequent production. The escapement goals of the Canadian stocks are currently being reviewed.

2.4.2.1 Northern British Columbia

2.4.2.1.1 Yakoun River

The CTC was unable to assess stock performance because the agency has not reported escapements since 2005. See Appendix Table B.2 for escapements through 2005.

2.4.2.1.2 Nass River

The Nass River is the largest river in Area 3, representing a group of approximately 25 streams. It flows southwest from the BC interior into Portland Inlet and the estuary is only 30 km from the Alaska-BC border. The Nass River drains an area of approximately 18,000 km^2 and is constrained by a canyon at Gitwinksihlkw (GW). The canyon was formed by the Tseax volcano in 1775 and is approximately 40 km upstream from the estuary. The mainstem of the Nass River is extremely turbid with visibility near zero for most of the year. Among the major Chinook producing tributaries, the Bell Irving River is glacially turbid while the Meziadin, Cranberry/Kiteen, Kwinageese and Damdochax rivers are relatively clear. Nass River Chinook salmon are primarily stream type and are thought to be far north migrating.

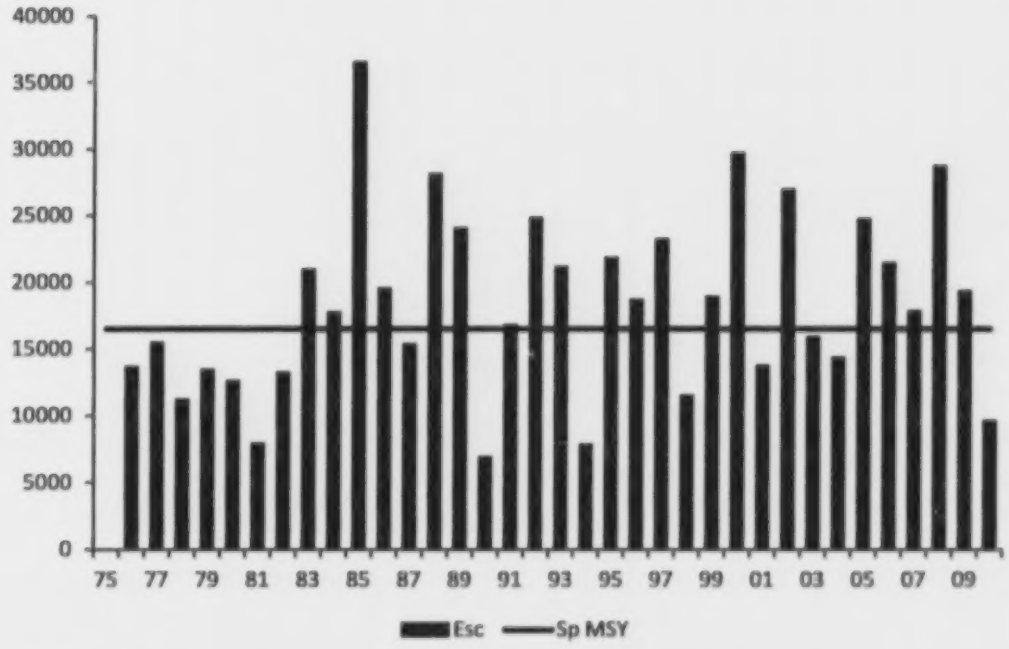

Figure 2.4.2.1.1 Nass River escapements of Chinook salmon from 1977 to 2011.

Escapement Methodology: Prior to 1992, CDFO observations of Nass River Chinook salmon escapement were based on visual counts. Programs using MR have been conducted since 1992 by the Nisga'a Fisheries to estimate total spawning escapement in the Nass River. The Nass MR program uses two fish wheels at Gitwinksihlkw (GW) in the lower Nass canyon and occasionally two wheels at Grease Harbor further upstream to apply tags. The Meziadin River fishway, a weir on the Kwinageese River and a deadpitch program on the Damdochax River are used for tag recovery. Tags were also recovered in upriver fisheries and on the spawning grounds. A modified Petersen model was used to estimate the total population of Chinook salmon past the tagging location. Spawning escapements were calculated as the estimated Chinook salmon population past GW from the MR studies, less upriver catches in sport and FN fisheries. Three tributaries with Chinook salmon populations, the Kincolith, Ishkeenickh and the Iknouk, enter the Nass River below GW. Visual estimates of these systems were augmented by fence counts of the Kincolith River in 2001, 2002, 2005 and 2007 to estimate escapements below the fish wheels.

Escapement Goal Basis: There is no CTC-accepted escapement goal for this stock. The Fisheries Operational Guidelines define two goals for managing Chinook fisheries: an operational escapement target of 20,000 fish, and a minimum escapement target of 10,000 fish. If escapements are projected to be below 10,000 fish, then no fishing on Nass River Chinook would be recommended. The median estimate of Smsy for the Nass River upstream of GW using the habitat model was 16,422 Chinook salmon based on a watershed area of 15,244 km^2 (Parken et al. 2006).

Agency Comments: Chinook escapement estimates produced before 1992 have been calibrated to the MR estimates. The Nisga'a Fisheries Working group, including CDFO, has accepted the historical escapement and terminal run values (Appendix B2). An SSP-funded project on the Kwinageese River and Damdochax Creek (Section 3.1.5.3) is designed to increase recoveries and improve the escapement estimates for the Nass Chinook aggregate.

2.4.2.1.3 Skeena River

The Skeena River is the second largest river in BC and drains an area of approximately 54,400 km^2. It supports the second largest aggregate of Chinook salmon stocks in BC with over 75 separate spawning populations. Four large-lake stabilized tributaries, the Kitsumkalum, Morice, Babine and Bear rivers, account for 65% of the total Chinook abundance in the Skeena. The Kitsumkalum River is glacially turbid and visual methods for enumerating salmon are not appropriate. By comparison, other major Chinook producing tributaries like the Morice, Bear, Babine and Kispiox rivers run relatively clear, especially in late summer when most of the Chinook spawning occurs. Skeena River Chinook are primarily stream-type (~97%) and are far north migrating. Most of the Skeena River Chinook populations are summer run but fish returning to the Cedar River and the upper Bulkley River have spring run.

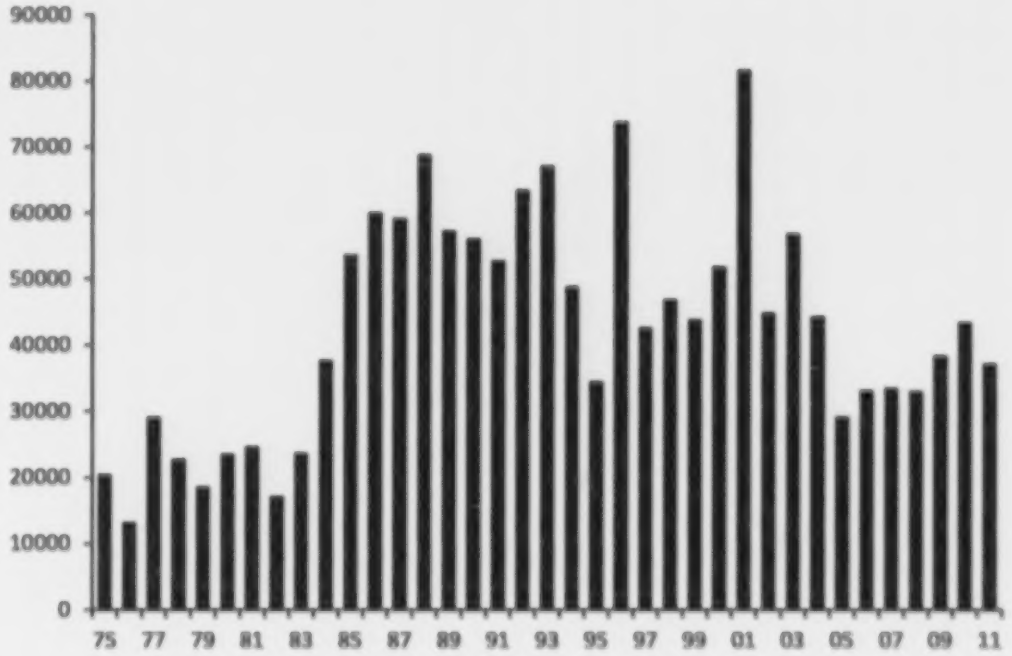

Figure 2.4.2.1.2 Skeena River escapements of Chinook salmon from 1975 to 2011.

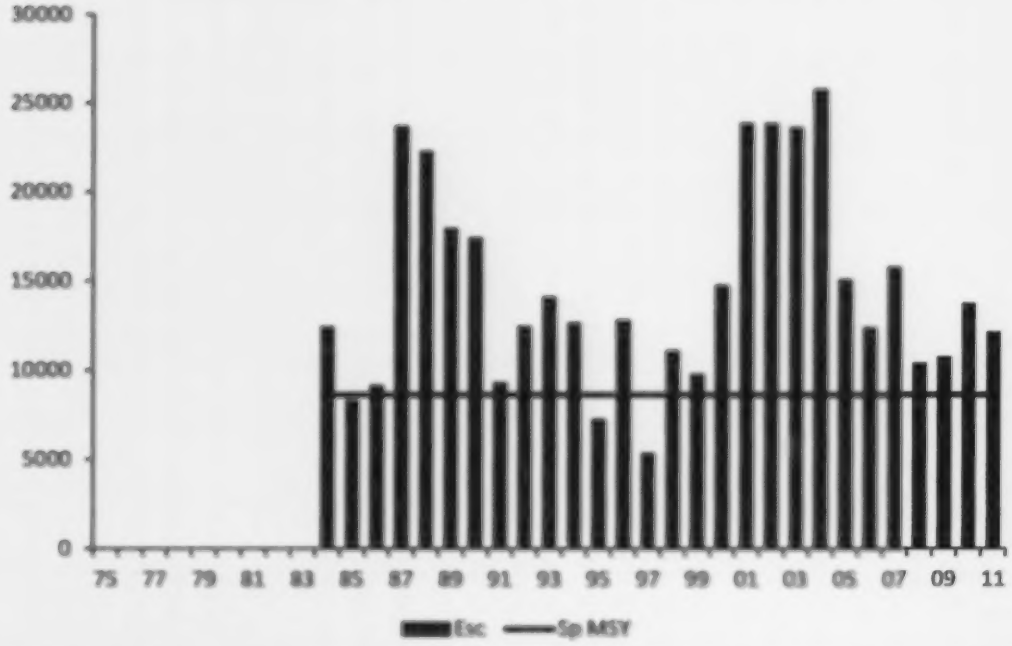

Figure 2.4.2.1.3 Kitsumkalum River escapements of Chinook salmon from 1984 to 2011.

Escapement Methodology: Chinook salmon escapements to the Skeena River are represented by an index that includes approximately 40 populations surveyed annually using a variety of techniques. Most of the escapement estimates are based on visual observations from helicopter, fixed wing aircraft and/or from stream walking surveys. Fish counting weirs are present on the Babine, Sustut and Kitwanga Rivers. The Kitsumkalum River is the exploitation rate indicator stock for the Skeena Chinook aggregate and escapements have been estimated using a MR program since 1984. The Kitsumkalum represents approximately 30% of the spawners measured by the escapement index. The Bear and Morice river populations have contributed 20 and 26% to the escapement index respectively since 1984. Visual estimates for these systems tend to underestimate their actual contribution to the total escapement in the aggregate.

Escapement Goal Basis: There is no CTC-accepted escapement goal for the Skeena River aggregate. The estimate of S_{MSY} for the Kitsumkalum indicator stock is 8,621 Chinook salmon based on stock-recruitment analyses (McNicol 1999, updated in Parken et al. 2006). Habitat-based estimates of S_{MSY} and other reference points are available for stocks within the Skeena River, but estimates of total escapement (or calibration of the visual indices) are needed to make them effective (Parken et al, 2006). Future assessments will partition this large aggregate into stocks by run timing, life history and geographic areas.

Agency Comments: Terminal fisheries in the Skeena River normally include commercial gillnet in the terminal exclusion area (River Gap Slough, Area 4), in-river sport, and aboriginal

fisheries. Estimates of in-river sport catch were not available from 1997 to 2002 but creel surveys were conducted on the Lower Skeena in 2003, 2010 and 2011. Consequently, the total terminal run estimates in these years include lower river sport catch but no estimate of upper river sport catch. Spawning escapements to the Kitsumkalum River have exceeded the point estimate of S_{MSY} in every year since 1998. There are two SSP funded projects on the Skeena River (see Sections 3.1.5.1 and 3.1.5.2) that provide estimates of total escapement for the Skeena River and its component tributaries. When complete, these projects will provide a 30-year time series of escapement estimates suitable for comparison with habitat-based or stock-recruit estimates of S_{MSY} and capacity.

2.4.2.2 Central British Columbia

2.4.2.2.1 Dean River

Chinook salmon populations in Area 8 consist of seven non-enhanced systems and the Bella Coola and Atnarko River system which is enhanced. Among non-enhanced systems the Dean River has the largest spawning population and the most consistent escapement surveys. Chinook salmon returning to the Dean River have summer timing and are predominantly stream type (94%).

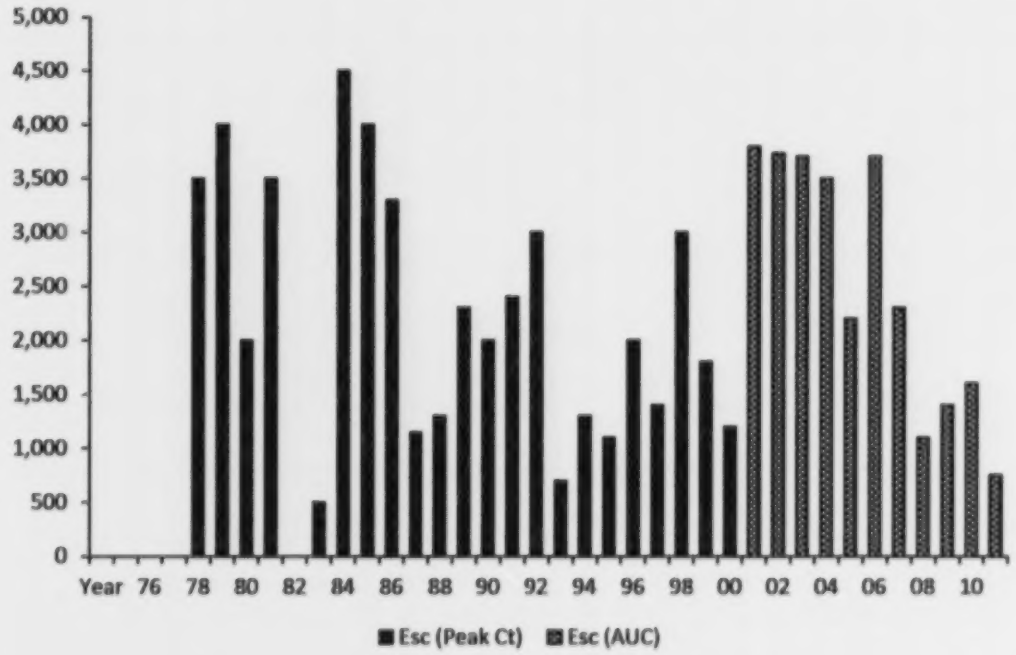

Figure 2.4.2.2.1Dean River escapements of Chinook salmon from 1978 to 2011.

Escapement Methodology: The Chinook salmon escapement index for the Dean River was derived using Area-Under-the-Curve (AUC) methodology based on 3 aerial counts. This technique has been used since 2001 although in years when viewing conditions are too poor to allow for the counts necessary to produce AUC estimates, a maximum likelihood procedure has

been used (e.g. 2004). The AUC derived escapement estimate for the 2011 Dean Chinook return was 750. A Chinook salmon MR program was attempted on the Dean River in 2006 to develop an expansion factor for converting the escapement indices into estimates of total escapement. The preliminary estimate of escapement based on the MR program was 5,478 compared to the maximum likelihood estimate of 3,689.

Escapement Goal Basis: There is no CTC-accepted escapement goal for this stock. Biologically-based goals for this complex of Chinook salmon spawning populations have not yet been developed.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for the Dean River (median S_{MSY} = 3,600), but estimates of total escapement are needed to make them effective.

2.4.2.2.2 Rivers Inlet

The Rivers Inlet escapement index consists of an aggregate of Chinook escapements to the Wannock, Kilbella and Chuckwalla Rivers. The Wannock River drains Owikeno Lake into the head of Rivers Inlet. It is about six kilometers long, over 100 m wide and is and glacially turbid. Wannock Chinook salmon are genetically distinct from other Chinook populations in the central coast of British Columbia. This ocean-type stock exhibits fall run timing and is renowned for its large body size due to 4 ocean and 5 ocean-age components in the return. The Kilbella and Chuckwalla river systems share an estuary on the north shore of Rivers Inlet. These systems are relatively small and can run clear but are often turbid as a result of precipitation. The Chinook salmon populations in the Chuckwalla and Kilbella Rivers have summer run timing and are stream-type. The largest contributor to the index is the Wannock River which represents an average of 76% of the production for this index over the past decade and over 90% in recent years.

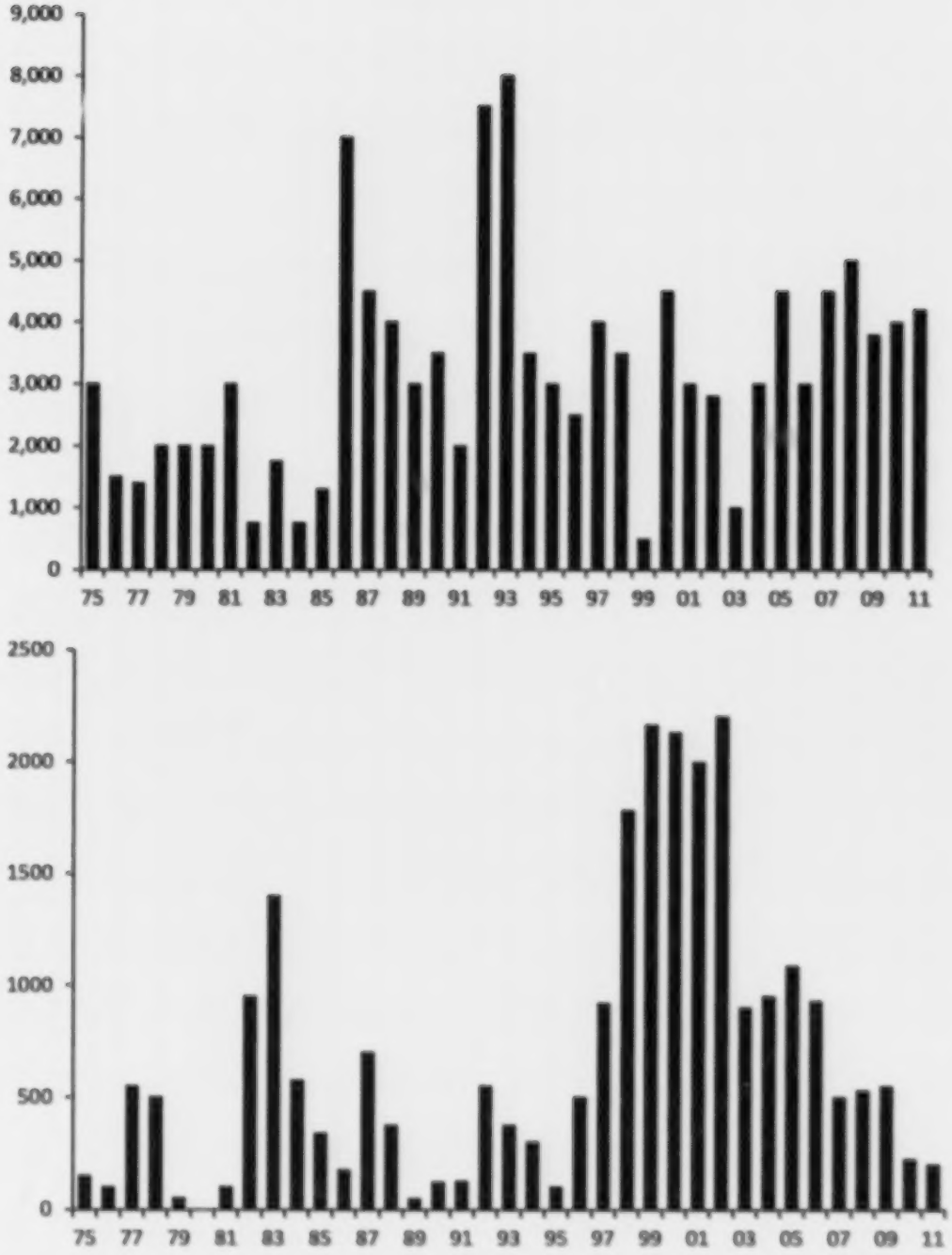

Figure 2.4.2.2.2Rivers Inlet Chinook salmon escapement index from 1975 to 2011. Top figure represents the Wannock River escapement estimate and the bottom figure is the Kilbella and Chuckwalla Rivers.

Escapement Methodology: Chinook salmon escapement estimates for the Wannock River are produced from an annual carcass recovery program. Estimates are derived by expanding the number of carcasses pitched. Expansions are subjective with some basis on water clarity, river height, and recovery effort. Programs to calibrate carcass recoveries with population estimates from MR experiments were conducted from 1991-1994 and 2000. Results suggest the estimates based on the subjective expansions of carcass recoveries underestimate the Wannock Chinook salmon population by approximately half. However bias and imprecision in the MR estimates has not allowed for full calibration of the carcass estimates.

Chinook salmon escapements for the Chuckwalla and Kilbella rivers are estimated using AUC methods applied to visual counts from helicopter surveys. Typically four flights are made during the spawning period. Only two flights were made in 2011 and Chinook salmon were only observed on one of the flights. The escapement to the Chuckwalla River was estimated at 200 fish but enumeration of the Kilbella River was not possible due to poor water clarity.

Escapement Goal Basis: There is no CTC-accepted escapement goal for these stocks. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available but estimates of total escapement are needed to make them effective. Habitat-based escapement goals were thought to overestimate S_{MSY} for the Wannock River because the stock may be limited by the relatively small amount of spawning area available (Parken et al. 2006).

Agency Comments: A small enhancement program occurs on the Wannock River but the contribution to the total population is unknown. Production from enhancement of the Kilbella and Chuckwalla rivers from 1990 to 1998 is thought to have had significant influence on escapements from 1994 to 2003 but estimates of the enhanced component are not available. Estimated returns to the Chuckwalla and Kilbella averaged 1300 Chinook salmon during the period of enhancement. Subsequently, returns decreased to an average of 760 Chinook salmon and the estimate of 225 Chinook salmon in 2010 was one of the lowest in recent history. It is unclear if these populations are returning to pre-enhancement levels or are experiencing an unrelated decline.

2.4.2.3 West Coast Vancouver Island and Georgia Strait

2.4.2.3.1 West Coast Vancouver Island

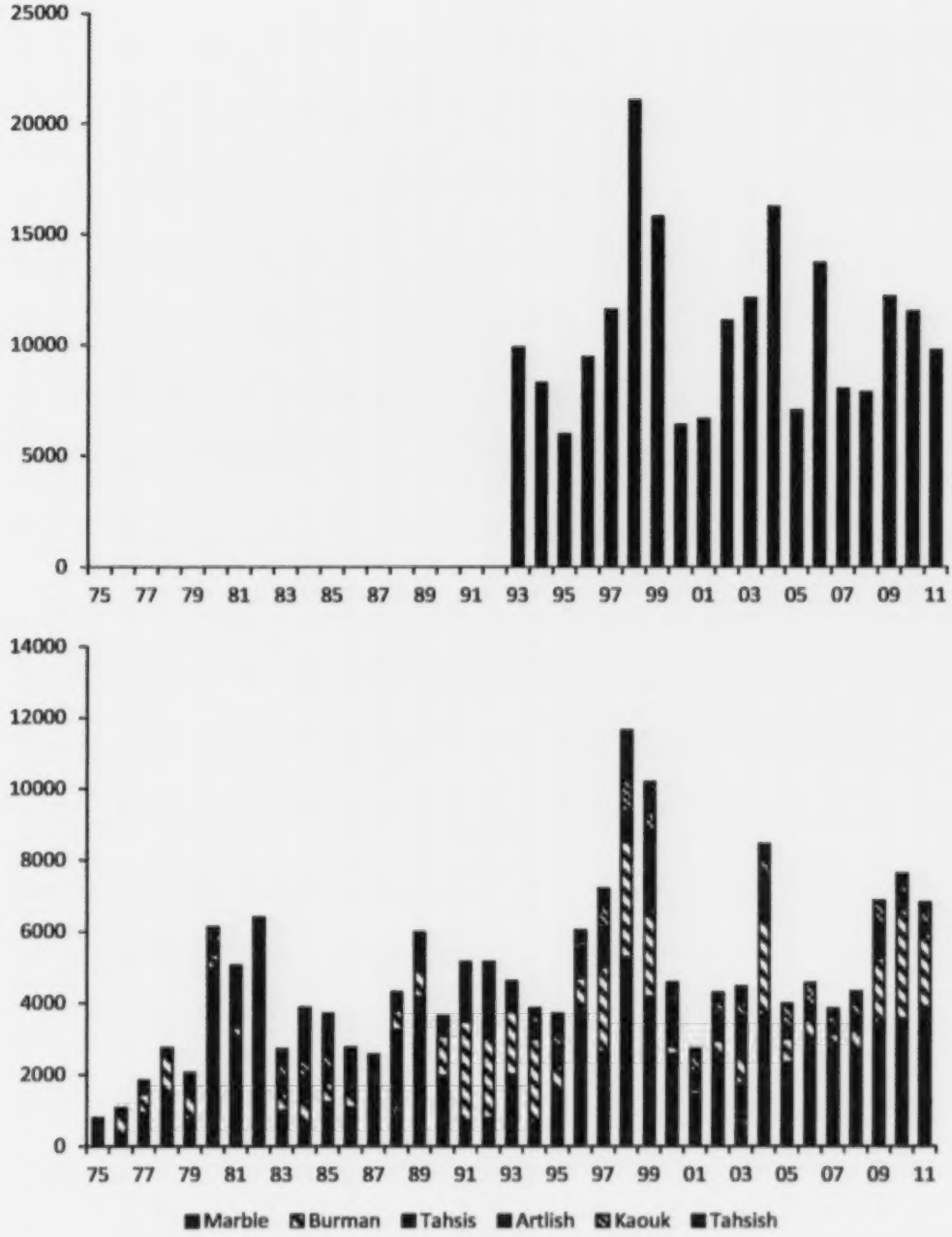

Figure 2.4.2.3.1 The WCVI Index of escapement includes both a six-stream and a 14-stream index. The six-stream index is reported in Appendix B.

Escapement Methodology: The WCVI index represents the sum of escapements for six rivers (Marble, Tahsis, Burman, Artlish, Kaouk, and Tahsish), which were chosen to provide an 'index' of escapement for wild WCVI stocks in general. These stocks were chosen based on historical

consistency of data quality. CDFO has developed a 14-stream expanded index which includes escapements to the six stream index plus the following WCVI streams: Colonial/Cayegle Creeks (Area 26), Leiner (Area 25), Megin, Bedwell/Ursus, Moyeha (Area 24) and Sarita, Nahmint (Area 23), and San Juan (Area 21). In 2005, the Colonial/Cayegle escapement was not available, and was therefore not included in the 14-stream index. Since 2007, a MR program has been conducted on the Burman River, a SSP-funded project (Section 3.1.3.2), in addition to the regular swim and foot surveys. However, the escapement estimate used for the index followed the same methodology since 2005.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for these stocks (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements as part of the SSP-funded projects at the Burman, Moyeha, and Kaouk rivers (Section 3.1.3). WCVI Chinook salmon have remained below the agency goals for these streams since 1999 despite terminal fishing closures in effect in Areas 24-26 in July each year and efforts to conserve WCVI Chinook salmon in Canadian fisheries. Escapements to all non-enhanced Clayoquot Sound and Kyuquot Sound Chinook salmon streams in the indices remain below 500 fish.

2.4.2.3.2 Upper Georgia Strait

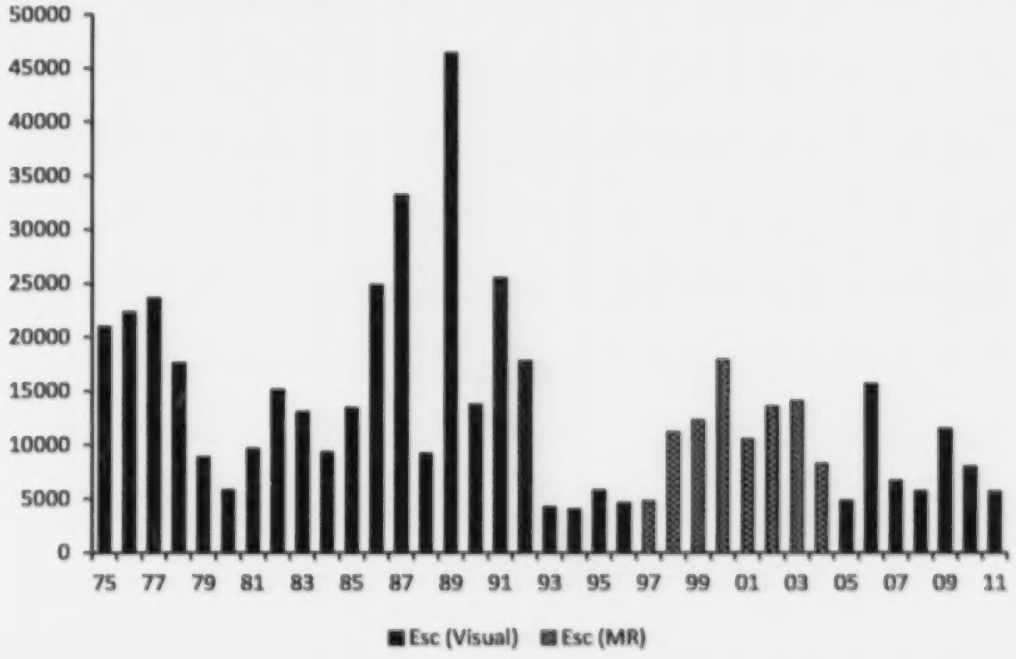

Figure 2.4.2.3.2Upper Georgia Strait stock group escapements of Chinook salmon from 1975 to 2011. The hatched bars in the histogram represent years when escapements to the Klinaklini

river were estimated using Fishwheel MR methods while the solid bars indicate estimates based on visual surveys.

Escapement Methodology: The Upper Strait of Georgia (UGS) stock index consists of five rivers (Klinaklini, Kakweiken, Wakeman, Kingcome, Nimpkish). Four are in Johnstone Strait mainland inlets and the Nimpkish River is on northeast Vancouver Island. The accuracy of escapement estimates in the mainland inlet systems is likely poor due to low visibility of glacial systems, remote access, and timing of surveys. Escapement estimates have primarily been based on aerial counts targeting other salmon species, which may not coincide with the main spawning period for Chinook salmon. Swim surveys and stream walks have been conducted in the Nimpkish River. A fish wheel program occurred on the Klinaklini River from 1997 to 2004. The escapement time series for the Upper Strait of Georgia stock group has been revised this year and varies from the series reported previously. The revised time series now includes estimates based on consistent methods within each river, and escapements to rivers missing escapement data for some years (i.e. no surveys) were estimated using the procedures described by English et al. (2007).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: Assessment of stock status is highly uncertain and the escapement time series requires standardization to better represent this stock group in the PSC Chinook Model. Differences in ocean distributions, run timing, and life history indicate that future assessments should separate the stock group into CUs. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for Salmon and Klinaklini rivers, but estimates of total escapement are needed to make them effective.

2.4.2.3.3 Lower Georgia Strait

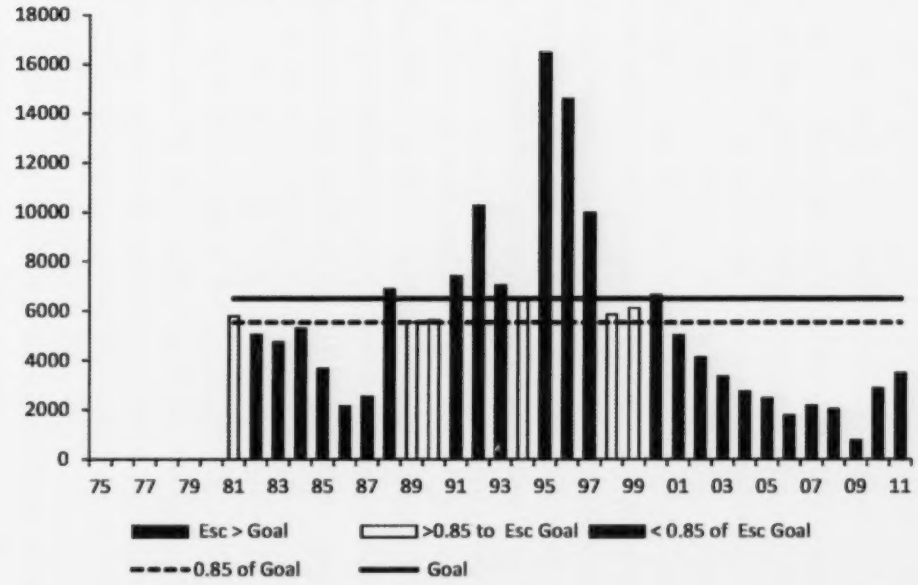

Figure 2.4.2.3.3 Escapements of Chinook salmon from 1981 to 2011 for the Cowichan River.

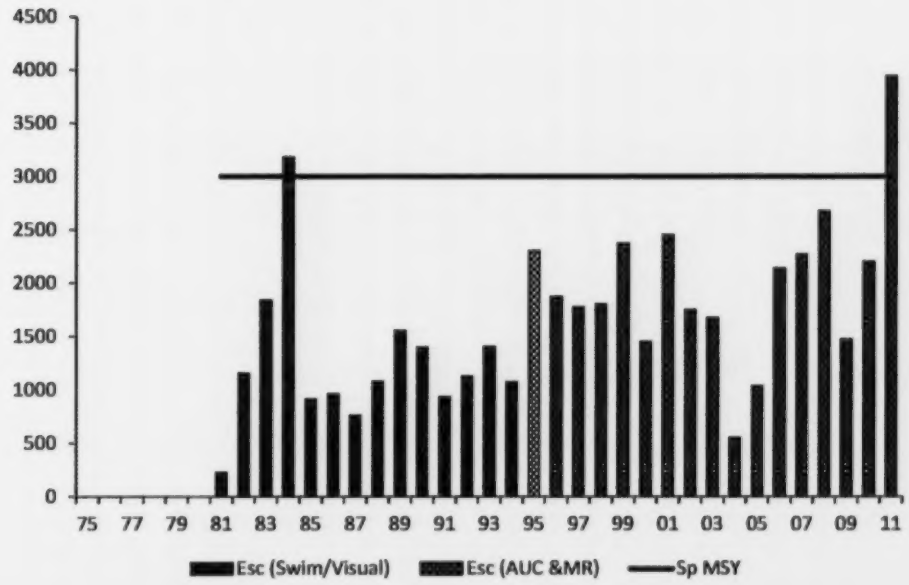

Figure 2.4.2.3.4 Escapements of Chinook salmon from 1981 to 2011 for the Nanaimo River.

Escapement Methodology: The LGS natural rivers monitored for naturally spawning fall Chinook salmon escapement are the Cowichan and Nanaimo Rivers. Total Chinook salmon returns have been estimated since 1975. Prior to 1988, escapement estimates from the Cowichan

River were derived from swim and aerial surveys. This approach was also used for the Nanaimo River prior to 1995. Since 1988 a counting fence has been used in the Cowichan River. Between 1995 and 2004 carcass MR surveys were used in the Nanaimo River, and since 2005, AUC methods have been used. Survey life is based on a tagging study in 2006.

Escapement Goal Basis: An escapement goal of 6,500 for the Cowichan River was accepted by the CTC in 2005 (Tompkins et al. 2005). There is currently no CTC-accepted escapement goal for the Nanaimo, however it has a habitat-based estimate for S_{MSY} of 3,000 spawners (median) (Parken et al. 2006).

Agency Comments: The Cowichan stock showed considerable increase in 1995 and 1996, followed by a rapid decline to conservation concern levels more than 15% below the escapement goal. Significant Canadian fishery management actions are used to reduce exploitation levels on the LGS natural stock group.

2.4.2.4 Fraser River Stocks

The Fraser River watershed is the largest Canadian producer of Chinook salmon. Fraser Chinook salmon consist of many local populations as described in CTC (2002b).

Much of the knowledge about the status of Fraser Chinook salmon is based on spawner escapement data. Most data are from visual surveys, which are generally biased low, although many estimates are considered to be reasonably precise. Visual survey data are generated from aerial surveys and the escapement estimate is usually obtained by dividing the peak count by 0.65 (Farwell et al. 1999). The CDFO continues to evaluate the appropriateness of this expansion factor and AUC methodology through calibration studies. MR projects exist for some systems, and fishways or resistivity counters are being employed in a few others, although most of the time series of escapement data from these projects are relatively short.

For populations other than the Harrison River, habitat-based models are being developed to estimate spawning capacity and spawner abundance producing maximum sustained yield (Parken et al. 2006). This habitat-based assessment will initially focus on predictive models based on Chinook salmon stock-recruitment relationships, although other habitat-based approaches will also be considered.

2.4.2.4.1 Fraser River Spring Run, Age 1.3

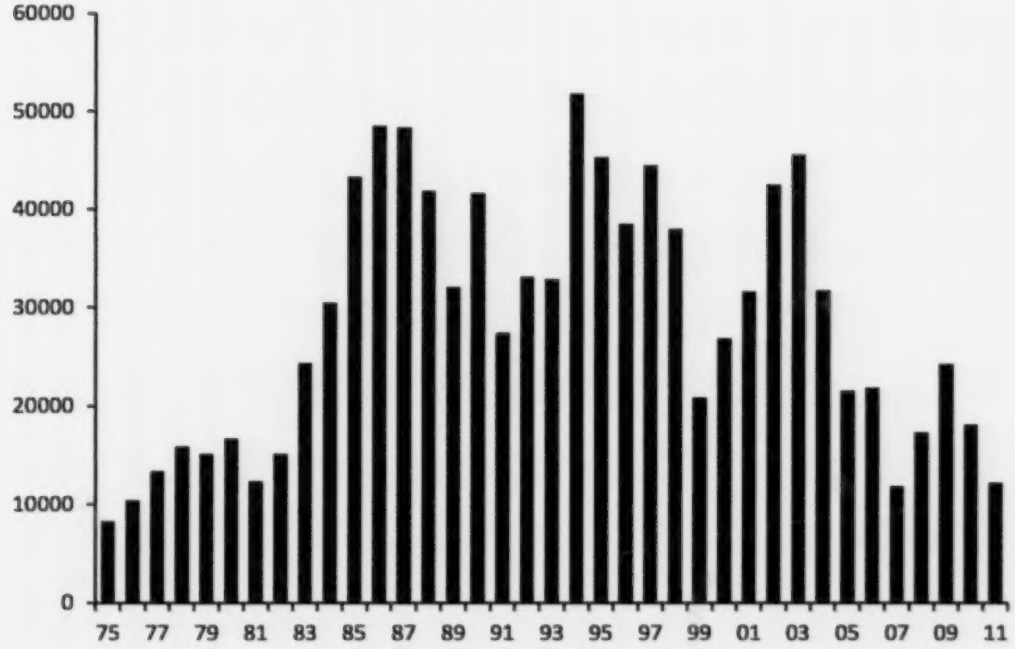

Figure 2.4.2.4.1Escapements of Chinook salmon from 1975 to 2011 for the Fraser River Spring-run Age 1.3 stock group.

Commentary: The Fraser Spring-Run Age 1.3 aggregate includes the Upper Pitt River and Birkenhead River stocks in the Lower Fraser, and the spring-run stocks of the Mid and Upper Fraser, North Thompson, and South Thompson, but excluding those of the Lower Thompson tributaries (CTC 2002b). Escapements are mostly estimated by expanded peak live counts of spawners, holders and carcasses, surveyed from helicopters or on foot. Escapements declined again in 2011, and also failed to exceed the parental brood escapement levels in 2006. Escapement to the aggregate was estimated at 12,104 in 2011; roughly 56% of the brood year escapement in 2006.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by mark-recapture and electronic resistivity counter methods. The stock group has declined substantially over the last decade and is a stock of conservation concern.

2.4.2.4.2 Fraser River Spring Run, Age 1.2

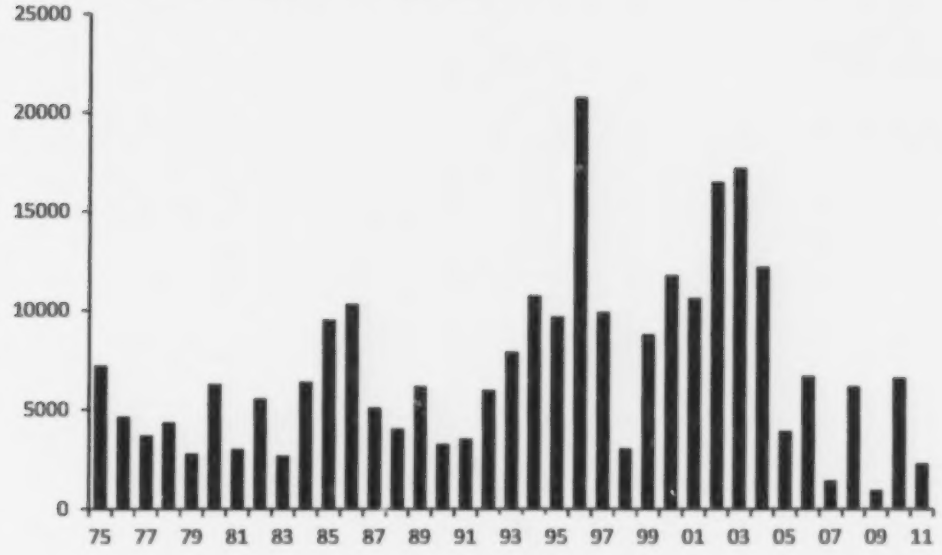

Figure 2.4.2.4.2Escapements of Chinook salmon from 1975 to 2011 for the Fraser River Spring-run Age 1.2 stock group.

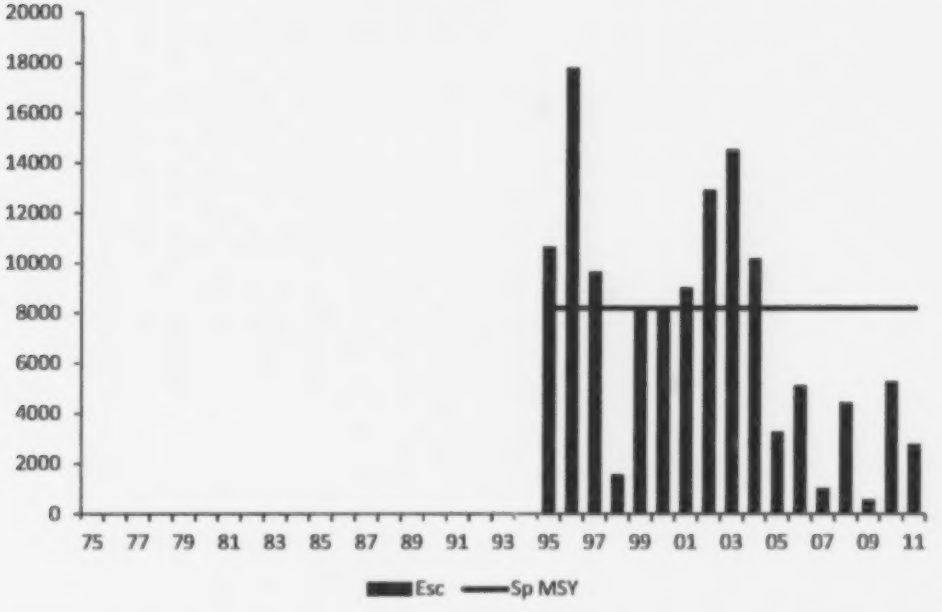

Figure 2.4.2.4.3Escapements of Chinook salmon from 1995 to 2011 for the Nicola River

Commentary: The Fraser Spring-run Age 1.2 aggregate includes six smaller body size populations that spawn in the Lower Thompson River tributaries, Louis Creek of the North Thompson and the spring-run fish of Bessette Creek in the South Thompson (CTC 2002b). Escapements are estimated visually using expanded peak counts of spawners, holders and carcasses in the Nicola River, Spius Creek, Coldwater River, Louis Creek and Bessette Creek. Escapements to the Deadman River are estimated by resistivity counter. Escapements again declined substantially in 2011 from levels observed in 2010, and however, escapements did exceed those of the 2007 parental brood. Aggregate escapement was estimated at 2,235. The estimated escapement remained critically low at Spius Creek (32).

The Nicola River is the exploitation rate indicator stock for the Fraser Spring-run Age 1.2 stock group. A MR program provides the high precision estimates of escapement by age and sex, and since 1995 Petersen disk tags have been applied by angling and post-spawned salmon carcasses examined for the presence of marks. Estimates of escapement have been generated using pooled Petersen methods. The expanded peak count time series for the Nicola River is generally less than the MR estimates (Parken et al. 2003), and the Nicola peak count series is included in the Fraser Spring-run Age 1.2 aggregate time series. The estimated escapement of 2,745 is substantially lower than that observed in 2010 (5,243), however, the 2011 escapement exceeds that of the 2007 parental brood (1,010). Since 1995 hatchery origin fish averaged 27% of the spawning escapement (range: 4%-71%).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by mark-recapture and electronic resistivity counter methods. The stock group has declined substantially over the last decade and is a stock of conservation concern. Since 2004, the Nicola River escapements have been less than the median estimate of S_{MSY} (9,300).

2.4.2.4.3 Fraser River Summer Run, Age 1.3

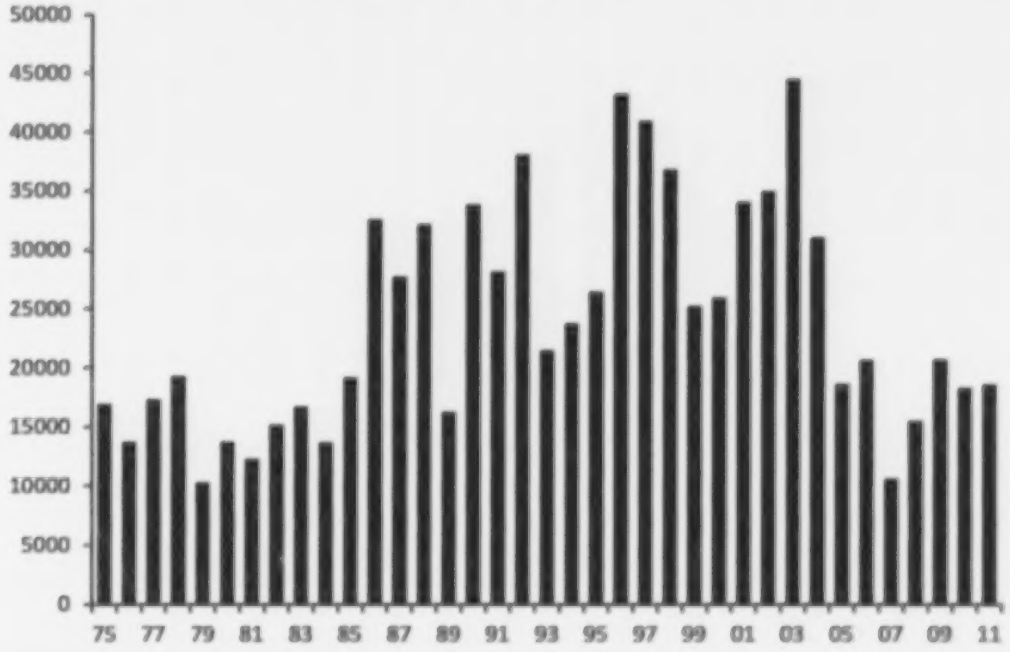

Figure 2.4.2.4.4Escapements of Chinook salmon from 1975 to 2011 for the Fraser River Summer-run Age 1.3 stock group.

Commentary: The Fraser Summer-Run Age 1.3 aggregate includes 10 populations, spawning in large rivers, mostly below the outlets of large lakes. These include the Nechako, Chilko and Quesnel rivers in the mid Fraser and the Clearwater River in the North Thompson watershed (CTC 2002b). Escapements are estimated by expanded peak counts of spawners, holders and carcasses surveyed from helicopters. Surveys of the Stuart River and North Thompson River were discontinued in 2004 due to unreliable counting conditions. Escapements in 2011 were very similar to those observed in 2010; however, they still represent approximately 90% of the brood year escapements in 2006. Aggregate escapement was estimated at 18,528.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and AUC methods. The stock group has declined over the last decade and is a stock of conservation concern.

2.4.2.4.4 Fraser River Summer Run, Age 0.3

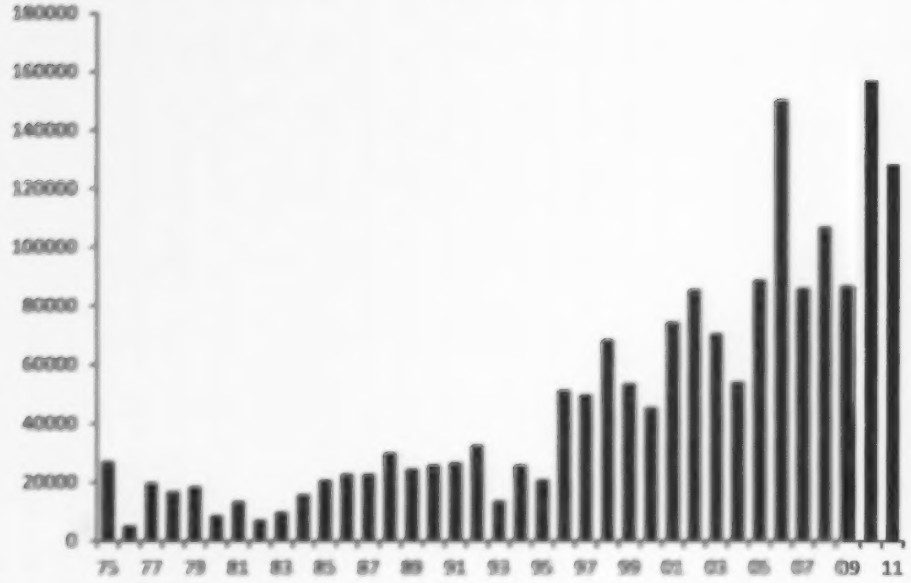

Figure 2.4.2.4.5Escapements of Chinook salmon from 1975 to 2011 for the Fraser River Summer-run Age 0.3 stock group.

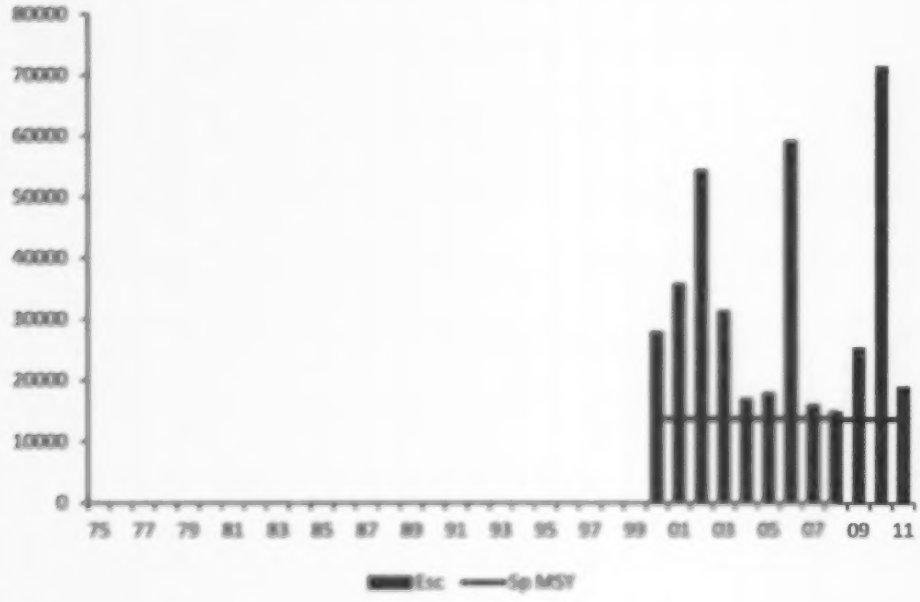

Figure 2.4.2.4.6Escapements of Chinook salmon from 2000 to 2011 for the Lower Shuswap River.

Commentary: The Fraser Summer-Run Age 0.3 aggregate includes six populations spawning in the South Thompson watershed and one in the lower Fraser. These include the Middle Shuswap, Lower Shuswap, Lower Adams, Little River and the South Thompson River mainstem, in the BC interior, and Maria Slough in the lower Fraser (CTC 2002b). Escapements are estimated using peak count visual survey methods. Escapements to the Summer Run Age 0.3 aggregate were estimated to be the third highest on record (127,957) in 2011, approximately 150% of the parental brood year escapements in 2007.

The Lower Shuswap River is the exploitation rate indicator stock for the Fraser Summer-run Age 0.3 stock group, and a MR program provides the high precision estimates of escapement by age and sex. Since 2000 (with the exception of 2003), tags have been applied to live fish by seining and salmon carcasses were examined later for the presence of marks. The estimated escapement of 18,874 is substantially lower than that observed in 2010 (71,379), however, the 2011 escapement exceeds that of the 2007 parental brood of 15,926. Since 2000, hatchery origin fish averaged 8% of the spawning escapement (range: 2%-22%).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR methods and novel methods via the Sentinel Stocks Program. Escapements have been increasing for this stock group over the last decade and the stock group is healthy and abundant. Since 2000, Lower Shuswap River escapements have exceeded the median estimate of S_{MSY} (12,800).

2.4.2.4.5 Fraser River Late Run (Harrison River)

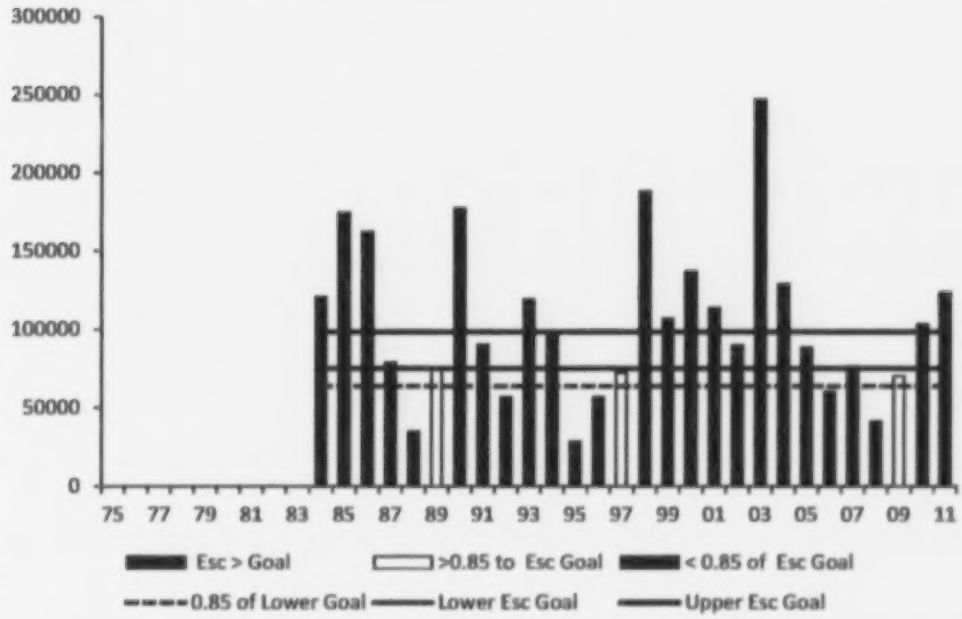

Figure 2.4.2.4.7Harrison River escapements of Chinook salmon from 1984 to 2011.

Commentary: Since 1984, MR studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements. Spawning escapements to the Harrison River in 2011 were estimated to be 123,647 adult Chinook salmon, and 20,759 jacks.

Escapement Goal Basis: Due to their natural abundance and importance in numerous British Columbia and Washington State fisheries, Harrison River Chinook salmon were designated as an escapement indicator stock (i.e., 'key stream' indicator) to aid in fulfilling commitments under the 1985 Pacific Salmon Treaty. In 1986, an interim escapement goal for Harrison River Chinook salmon was established at 241,700 fish, based on doubling of the escapement estimate obtained from a MR program in 1984. In 2001, an escapement goal range was developed for Harrison Chinook salmon using a Ricker stock-recruit approach and is described in CTC (2002b). The escapement goal range that was proposed was 75,100-98,500 with the upper bound equal to the upper 75% confidence limit derived from a bootstrap procedure. This range was reviewed and accepted by the CTC. Estimated spawning escapements in the Harrison have exceeded this escapement goal range in nine years from 1984 to the present. Escapements have fluctuated substantially with no apparent trend in the time series.

Agency Comments: Harrison River Chinook salmon are white-fleshed fish that return to spawn during the fall. They are unusual in that fry migrate into the lower Fraser River and estuary shortly after emergence. This stock spends 2-4 years in the coastal marine environment before returning to spawn. The Harrison River stock is one of the largest naturally spawning Chinook

salmon populations in the world and makes important contributions to fisheries in southern BC, and Washington State.

2.4.3 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

The PSC escapement indicator stocks in Washington and Oregon, are separated into five regional groups: Puget Sound, Washington Coastal, Columbia River, North Oregon Coastal, and Mid Oregon Coastal. The indicator stocks include a variety of run timings and ocean distributions. Some of these indictor stocks are components in the different stock groups listed in Attachment I-IV tables in the treaty.

Biologically-based escapement goals have been reviewed and accepted by the CTC for three fall stocks (Queets, Quillayute, Hoh as part of the Washington Coastal Fall Natural Stock Group), two spring/summer stocks (Queets, Hoh), four Columbia River stocks (Lewis, Upriver Brights and Deschutes as the Columbia River Fall Stock Group and the Columbia River Summer Stock Group), and three Oregon coastal stocks (Nehalem, Siletz and Siuslaw as the Far North Migrating Oregon Coastal Falls Stock Group).

2.4.3.1 Puget Sound

Puget Sound escapement indicator stocks include spring, summer/fall and fall Chinook salmon stocks from the Nooksack, Skagit, Stillaguamish, Snohomish, Lake Washington, and Green systems. They tend to have a more local distribution than most coastal and Columbia River stocks and are caught primarily in WCVI AABM fisheries, and Canadian and US ISMB fisheries. Escapement for these stocks is assessed in terms of natural escapement, which is the total of natural- and hatchery-origin fish spawning naturally on the spawning grounds.

2.4.3.1.1 Nooksack River

The Nooksack River drains into Puget Sound near Bellingham. The Nooksack spring Chinook salmon stock includes early-timed populations returning to the North and South forks of the Nooksack River.

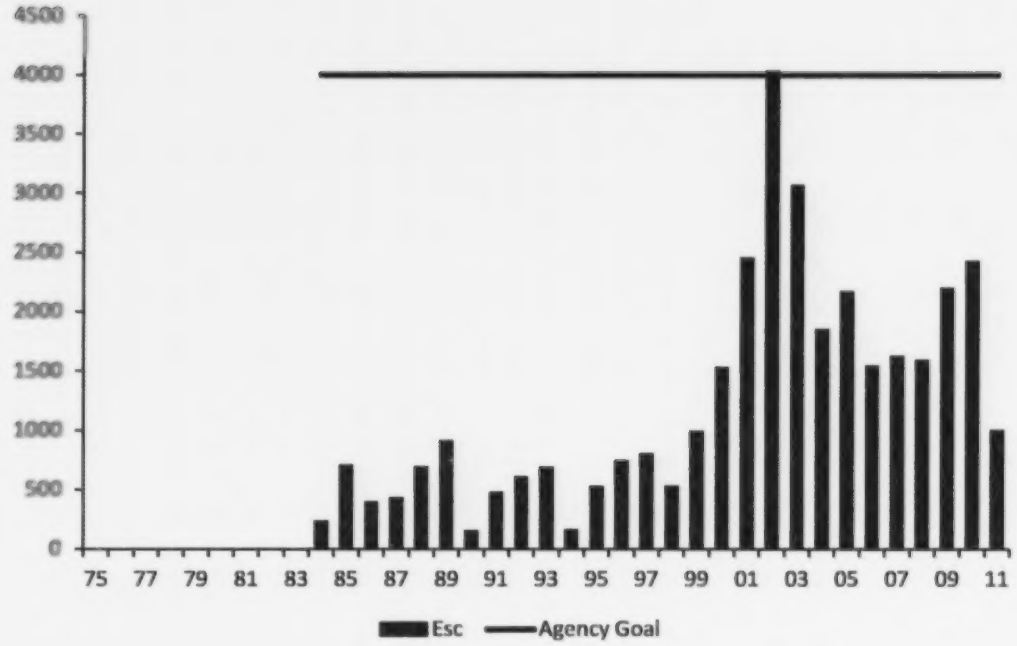

Figure 2.4.3.1.1 Escapement of natural and hatchery origin Nooksack River spring Chinook salmon to the spawning grounds from 1984 through 2011.

Escapement Methodology: Estimates of the escapement in the South Fork have traditionally been based on the number of redds observed prior to the first of October expanded by 2.5 redds per spawner. Since 1999, this estimate has been further refined by separating hatchery-origin strays (North/Middle Fork and summer/fall Chinook salmon) based on CWTs, otolith marks or adipose fin clips, and also by assigning the natural origin spawners to the South Fork, North/Middle Fork and summer/fall hatchery stocks. The latter step is based on the expansion of the microsatellite DNA stock assignment of carcasses collected through the first week of October applied to the total estimated natural origin spawners. The majority of the run and the natural escapement is composed of hatchery-origin returns from the supplementation program. During 1999-2008, only 15% of the escapement in the North Fork and 50% of the escapement in the South Fork was composed of natural origin fish and annually ranged between 117 to 390 fish combined (CCMP 2010). In 2011, the projected natural escapement estimate was 875 for the North Fork and 124 for the South Fork.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state-tribal escapement goal established for this Chinook salmon management unit is 4,000 spawners as an upper management threshold (UMT) and a low abundance threshold (LAT) of 2,000 natural origin fish (CCMP 2010). The UMT as established by the state-tribal managers is generally considered as the adult (age 3+) escapement level associated with maximum sustained catch. The LAT is the escapement level below which dramatic declines in long term productivity could occur. Since listing in 1999 as threatened

under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement. The stock achieved the LAT in 2010.

2.4.3.1.2 Skagit River Spring

The Skagit River drains into northern Puget Sound near Mount Vernon, and is the largest drainage basin in Puget Sound. The Skagit spring Chinook salmon stock includes early-timed populations returning to the Upper Sauk, Cascade, and Suiattle Rivers.

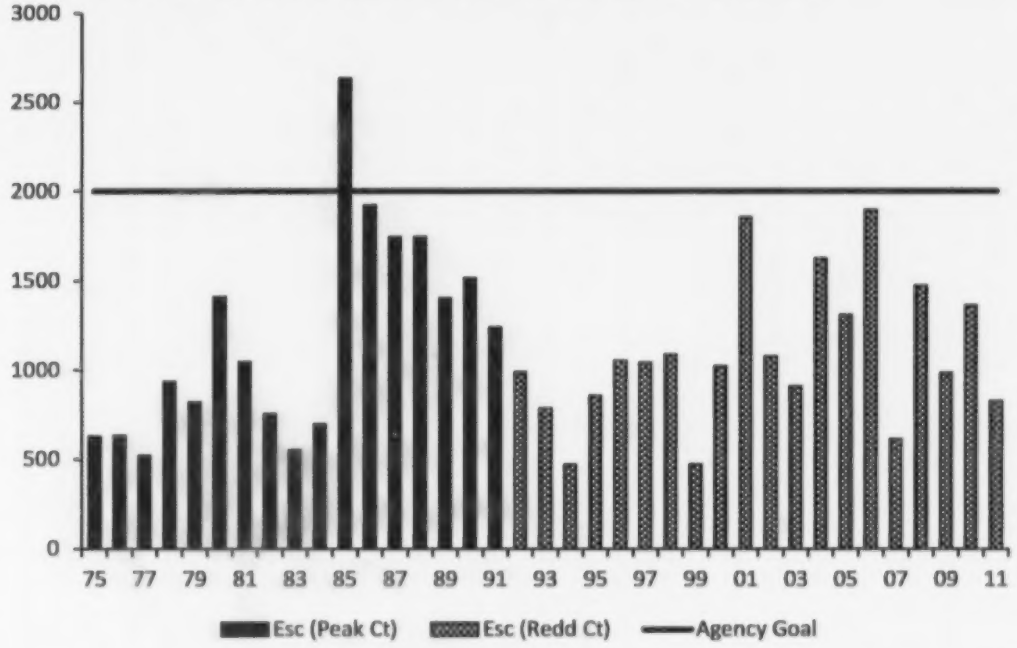

Figure 2.4.3.1.2 Escapement of Skagit River spring Chinook salmon to the spawning grounds from 1975 through 2011.

Escapement Methodology: Due to changes in spawning index areas, beginning in 1992 for the Cascade stock and 1994 for the Sauk and Suiattle stocks, escapements are not directly comparable to previous numbers. In the Upper Sauk, redds are counted from RM 21.2-39.7 (Darrington to Forks), in the North Fork Sauk from the mouth to the falls, and in the South Fork Sauk (RM 0-2.5). This method replaced the peak live and dead count approach in 1994. A redd life value of 30.2 days is used (avg of foot survey-based estimate = 22.9 days and AUC back calculated = 37.5 days). In the Cascade River, redds are counted in the mainstem upstream of RM 7.8 and in the lower north fork and south fork, and Found, Kindy, and Sonny Boy creeks. Two helicopter flights and five foot surveys occurred over RM 7.8-18.6. In the Suiattle basin, redds are counted in mainstem Suiattle, and in Big, Tenas, Straight, Circle, Buck, Lime, Downey, Sulphur, and Milk creeks. Prior to 1994, peak live and dead fish counts in Big, Tenas, Buck, and Sulphur were used. Escapement may include very small number of hatchery strays in these natural production areas. Past PSC funded studies on straying of Marblemount Hatchery spring Chinook salmon focused on the area immediately adjacent to the hatchery which is

outside the survey reach for natural production. The 2011 escapement estimate was 825 natural spawners.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The current UMT used by the state and tribal co-managers for the Skagit spring Chinook salmon management unit is 2,000 with a LAT of 576 (CCMP 2010). Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate ceiling rather than for a UMT or LAT escapement.

2.4.3.1.3 Skagit River Summer/Fall

The Skagit River summer/fall Chinook salmon stock includes the Upper Skagit summer, Sauk summer, and Lower Skagit fall run populations.

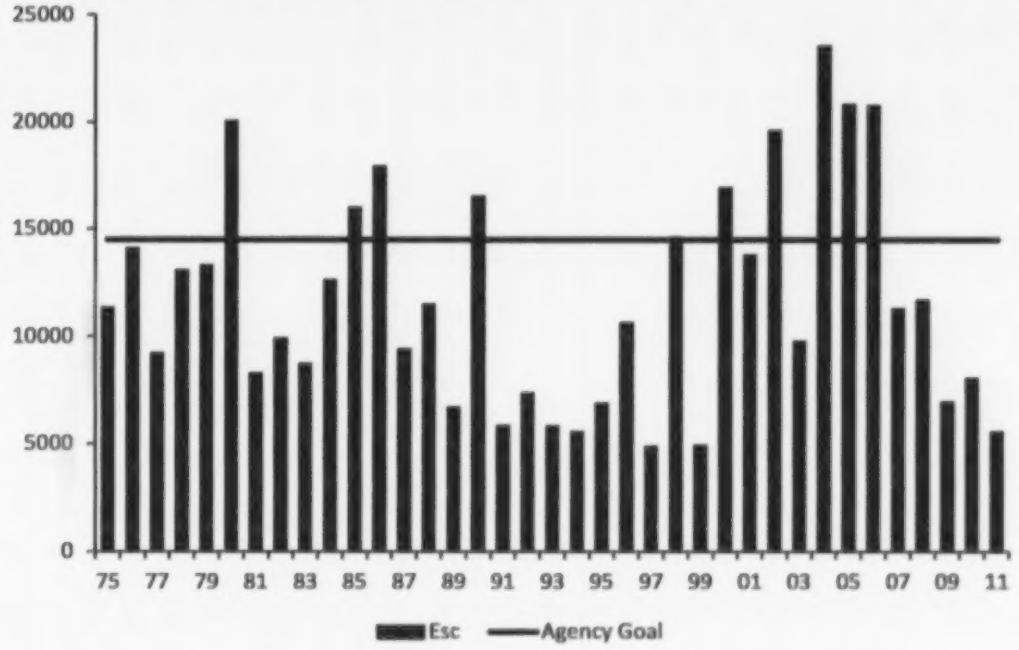

Figure 2.4.3.1.3 Escapement of Skagit River summer/fall Chinook salmon to the spawning grounds from 1975 through 2011.

Escapement Methodology: Escapement of Skagit summer/fall Chinook salmon was estimated using expansion of redd counts from helicopter surveys of mainstem areas and foot surveys of smaller tributaries. The counts are expanded by the area-under-the-curve method (Smith and Castle 1994). This method assumes a 21-day redd life and 2.5 adult spawners for each estimated redd. The estimate is then reduced by 5% to account for "false" redds counted during aerial surveys. Natural escapement is predominantly offspring from natural origin parent spawners; the remainder is hatchery origin fish from the wild stock tagging program that started in 1994. Natural escapement does not include the brood stock collected for this program. The 2011 escapement estimate was 5,536. The terminal run estimate was 9,181.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: The UMT used by the state-tribal co-managers for the Skagit summer/fall Chinook salmon management unit is 14,500 based on a recent assessment of freshwater productivity and accounting for variability and biases in management error (CCMP 2010). The LAT is 4,800 spawners. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate rather than for a UMT or LAT escapement. In years when the UMT is expected to be exceeded, terminal fisheries can be expanded subject to the overall ceiling exploitation rate.

2.4.3.1.4 Stillaguamish River

The Stillaguamish River drains into northern Puget Sound between Everett and Mount Vernon. The Stillaguamish Chinook salmon stock includes a run of summer-timed Chinook salmon in the North Fork of the Stillaguamish River and a much smaller number of fall fish in the South Fork and mainstem of the Stillaguamish River.

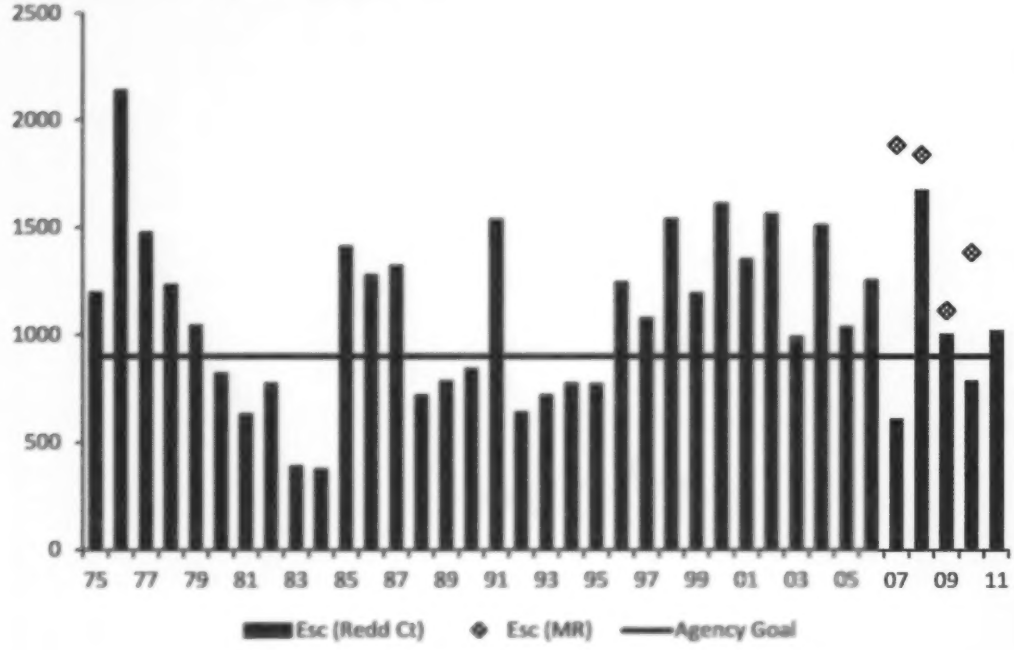

Figure 2.4.3.1.4 Escapement of Stillaguamish River Chinook salmon to the spawning grounds from 1975 through 2011.

Escapement Methodology: Escapement estimates for Stillaguamish Chinook salmon were based on redd-count expansions, assuming a 21-day redd life. The North Fork of the Stillaguamish River is surveyed more extensively, with one to three aerial surveys and AUC redd estimates. The escapement estimates for the South Fork of the Stillaguamish River uses a peak redd count and assumes 2.5 fish per redd. Boulder and Squire Creeks on the North Fork of the

Stillaguamish River and Jim Creek on the South Fork of the Stillaguamish River are also surveyed. Spawning escapement estimates of fall Chinook salmon may be biased low due to incomplete redd counts using visual sampling methods. Evidence of this is supported by mark-recapture studies in 2007 through 2010 funded through the Sentinel Stocks Program where escapement estimates were 1.1 times to 3.1 times higher than those from redd counts. Natural escapement excludes brood stock taken for the wild stock indicator program after 1987 but does include spawning hatchery fish from this production. Total natural spawning escapement in 2011 was estimated at 1,017 fish.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: State-tribal co-managers have established a UMT for this management unit of 900 natural origin spawners (600-North Fork of the Stillaguamish River and 300-South Fork of the Stillaguamish River and mainstem) with a LAT of 700 (CCMP 2010). The summer Chinook salmon supplementation program, which collects brood stock from the North Fork of the Stillaguamish River return, was initiated in 1986 as a Pacific Salmon Treaty indicator stock program, and its current objective is to release 200,000 tagged fingerling smolts per year. Since 2000, an average of approximately 140 adults has been collected annually from the spawning population for this program. Most releases are into the North Fork of the Stillaguamish River, via acclimation sites. Relatively small numbers of smolts have been released into the South Fork of the Stillaguamish River. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.

2.4.3.1.5 Snohomish River

The Snohomish River is located in northern Puget Sound near Everett. The Snohomish Chinook salmon stock includes the Skykomish and Snoqualmie summer/fall run populations. Skykomish Chinook salmon spawn in the mainstem of the Skykomish River, and its tributaries including the Wallace and Sultan Rivers, in Bridal Veil Creek, the South Fork of the Skykomish River between RM 49.6 and RM 51.1 and above Sunset Falls (fish have been transported around the falls since 1958), and the North Fork of the Skykomish River up to Bear Creek Falls (RM 13.1). Snoqualmie Chinook salmon spawn in the Snoqualmie River and its tributaries, including the Tolt River, Raging River, and Tokul Creek.

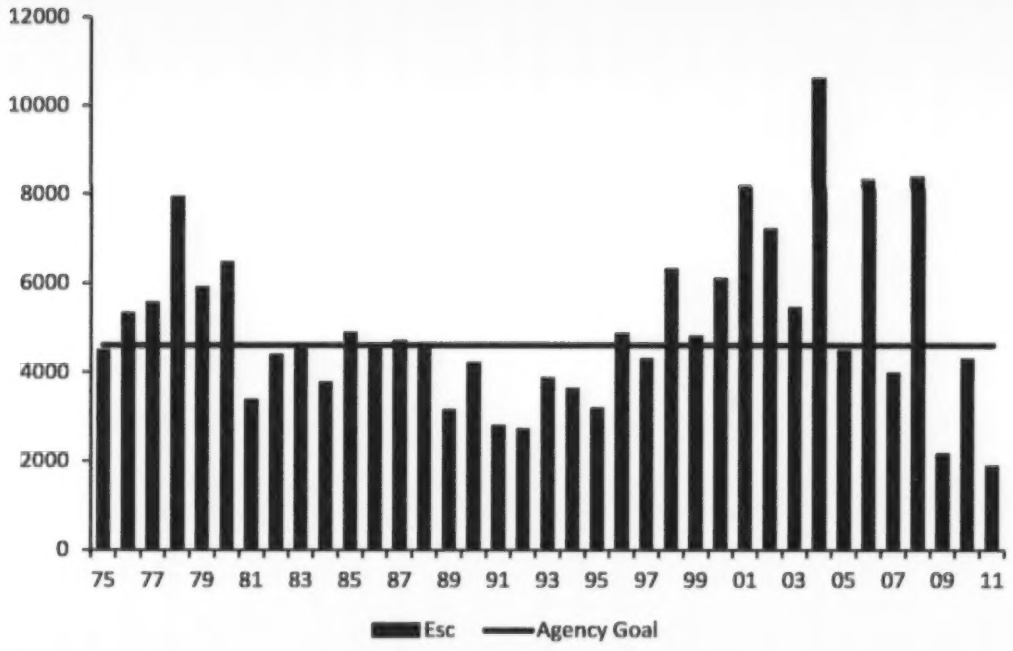

Figure 2.4.3.1.5Escapement of Snohomish River Chinook salmon to the spawning grounds from 1975 through 2011.

Escapement Methodology: Escapement was estimated using expansion of redd counts conducted by a combination of helicopter, float, and foot surveys, and from fish counts at the Sunset Falls fishway. The natural escapement estimate includes a significant contribution of hatchery strays from Wallace and Bernie Kai-Kai Gobin (Tulalip Tribe) facilities. The 2011 escapement was estimated at 1,880 natural spawners.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state-tribal co-managers have a UMT for this stock of 4,600 natural origin spawners (CCMP 2010). The LAT for Snohomish summer/fall Chinook salmon is 2,800 fish. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.

2.4.3.1.6 Lake Washington

The Lake Washington Chinook salmon stock includes the fall run populations in the Cedar River and in the North Lake Washington tributaries of Bear, Cottage, and Issaquah creeks. A hatchery is located on Issaquah Creek and Chinook salmon spawning in Issaquah Creek are not included in the natural escapement for Lake Washington.

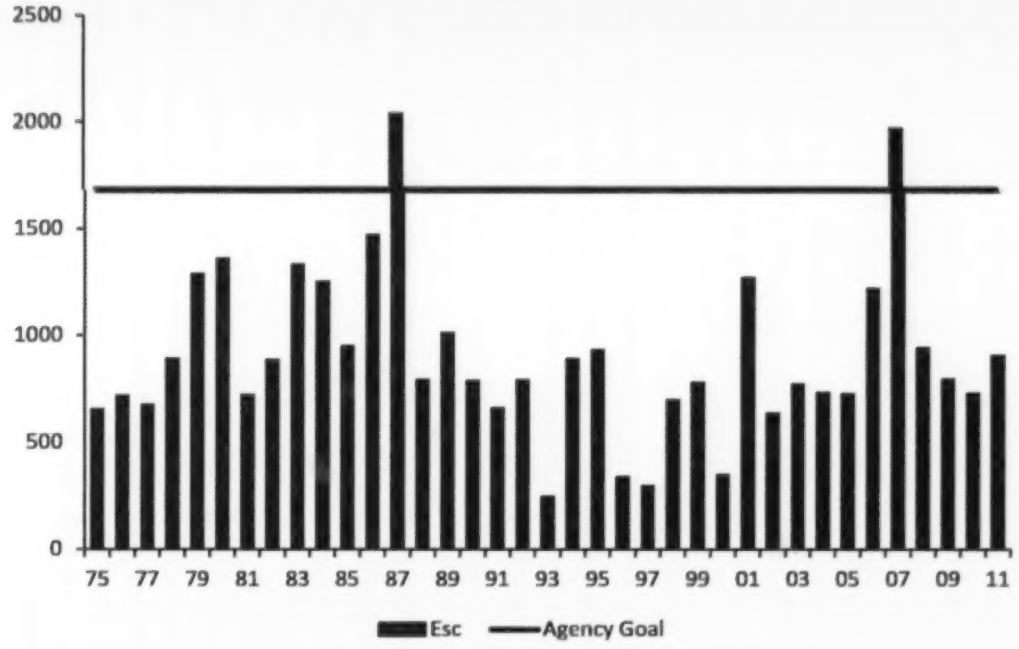

Figure 2.4.3.1.6Escapement of Chinook salmon to the spawning grounds in the tributaries of Lake Washington (Cedar River and Bear and Cottage Creeks) from 1975 through 2011.

Escapement Methodology: Natural spawners in Issaquah Creek that spawn below the Issaquah Hatchery are not included in the graph. It should be noted that although there are no hatchery fish released into the Cedar River, an average of 23% of the spawners in 2003-08 were adipose clipped from mass-marked hatchery production, presumably from Issaquah Hatchery (CCMP 2010). Escapement in the Cedar River is estimated using expansion of total redd counts. In recent years, estimates of spawner abundance have also been made using redd counts performed over the entirety of the spawning area downstream of Landsburg Dam (CCMP 2010). These data were used to convert previous estimates of escapement within the index reach to estimates of spawner abundance (as would be derived through redd counts) for the entirety of the river (below the dam) using simple linear regression. Escapement to the North Lake Tributaries is estimated using live counts and AUC methods. The 2011 escapement for Lake Washington was 906 spawners, including 101 primarily hatchery origin fish in Bear and Cottage creeks.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: A state-tribal interim UMT escapement goal of 1,200 Chinook salmon for an index reach in the Cedar River was established in 1993 based on average escapements in 1965-69. This goal for the index reach was converted to 1,680 Chinook salmon for the entirety of the river downstream of the dam. This number (1,680) reflects a redd-based escapement value consistent with the interim escapement goal derived using AUC methodology. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement in the Cedar River, except

when the UMT is expected to be exceeded, some additional fishing in Lake Washington is considered.

2.4.3.1.7 Green River

The Green River Fall Chinook salmon stock consists of a single population spawning in the mainstem Green River and two of its major tributaries, Newaukum and Soos creeks.

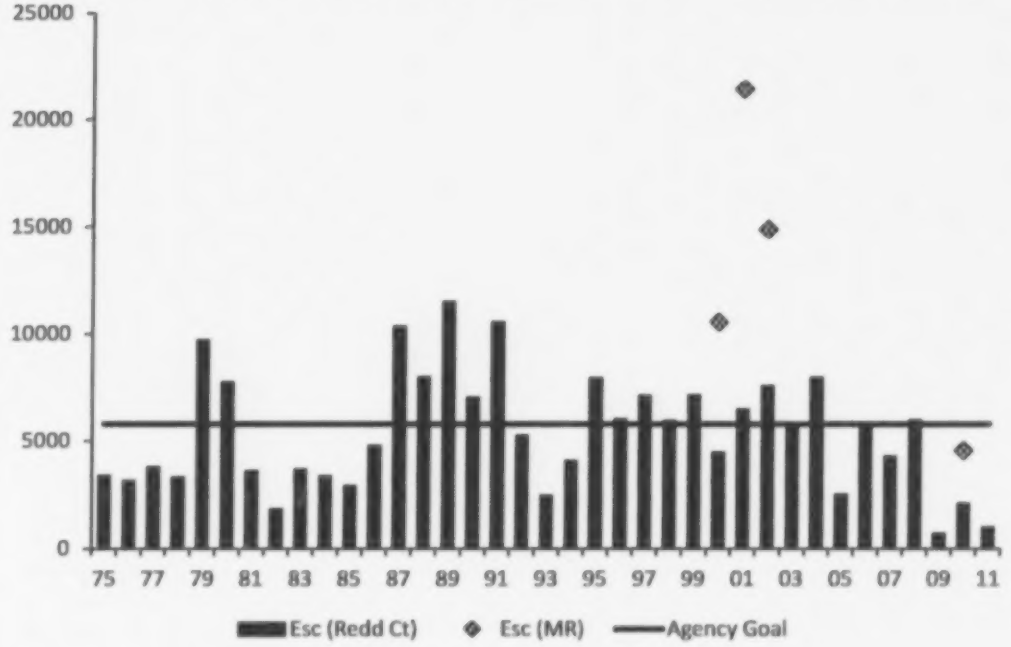

Figure 2.4.3.1.7Escapement of Green River Chinook salmon to the spawning grounds from 1975 through 2011. The

Escapement Methodology: Escapement is estimated from redd count expansion method that has varied over the time series by the extent of spawning survey coverage. The method used until about 1996 involved an index area redd count multiplied by 2.6 to estimate total redds then multiplied by 2.5 fish/redd to produce estimated escapement. The 2.6 index to total redd expansion factor was based on a 1976-1977 U.S. Fish and Wildlife Service MR study. Since 1996, the survey areas have broadened and the associated expansion factor of 2.6 has been reduced to the point that the redd counts in 2009 have complete spawning reach coverage. The method used in recent years provides natural escapement estimates for the mainstem Green River and Newaukum Creek. Newaukum Creek redds are counted during foot surveys. The mainstem Green River is surveyed by boat and by air. Some parts of the river (i.e. – the Gorge) are only surveyed by air. Boat surveys are generally done once a week, or twice a week in years with a large numbers of pink salmon. One aerial survey is made during the peak of spawning, more if budgets permit. Certain index reaches of the river are surveyed every week by boat to develop a cumulative redd count total for those reaches. These index reaches are distributed throughout the river. Visible redds are counted for the entire floatable part of the river by boat each week and for the entire river by helicopter during the peak. The ratio of visible redds seen by boat to those

seen by air (boat surveys assumed to be best) is used to estimate how many redds would be seen by boat in the unfloated reaches. This provides an estimate of how many visible redds exist during the peak of spawning. To get from peak redds to cumulative total redds, the visible redds in the index reaches during the peak are compared to the season total for those index reaches. Different areas of the river have different ratios of peak visible redds to season totals. Expansion of non-index visible redds to season total redds uses the ratio from nearby index reaches of the same general character. The CTC considers these estimates from redd counts as index values rather than estimates of total escapement. Estimates of total escapement from MR studies in 2000-02 funded through the U.S. Letter of Agreement were about 2.5 times higher than the escapement estimate from redd count expansion. In 2010, the MR-based escapement from a study funded under the Sentinel Stocks Program was more than twice as high as the redd count expansion estimate. There is a large hatchery program in this basin and these fish comprise a large portion of the return. Hatchery fish contribution to the natural escapement ranged from 53% to 65% for 2004-07. The escapement in 2011 from redd count expansion was 993 Chinook salmon of mixed hatchery and natural origin.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state-tribal UMT escapement goal of 5,800 naturally spawning adults is the average of the 1965-1976 escapements (Ames and Phinney 1977). The LAT is 1,800 fish. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been on a ceiling exploitation rate in the southern U.S. pre-terminal fisheries and for the UMT in the terminal fisheries.

2.4.3.2 Coastal Washington

Coastal Washington stocks include spring, summer, and fall Chinook salmon from the Hoko, Quillayute, Hoh, and Queets Rivers, and from Grays Harbor. Coastal Washington stocks have a northerly distribution and are vulnerable to southern US fisheries primarily as mature fish during their spawning migrations. They are caught primarily in SEAK and NBC AABM fisheries and in terminal net fisheries.

2.4.3.2.1 Hoko River

The Hoko River is located at the extreme western end of the Strait of Juan de Fuca and is not a population listed under the U.S. ESA as part of the Puget Sound Chinook salmon Endangered Species Unit. Hoko River Chinook salmon spawn primarily in the mainstem of the Hoko, with limited spawning in larger tributaries.

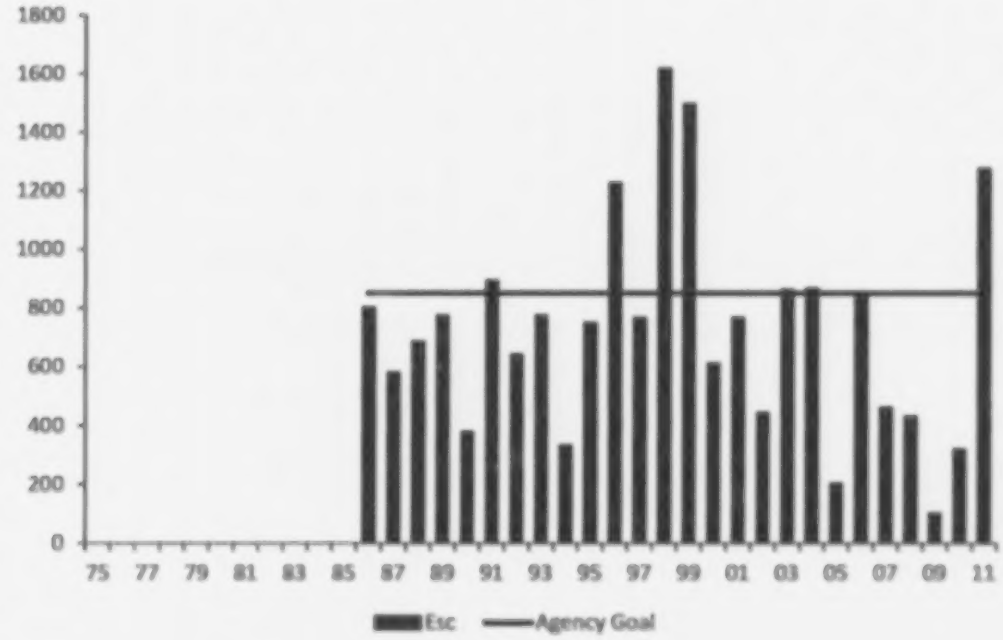

Figure 2.4.3.2.1 Escapement of Hoko River Chinook salmon to the spawning grounds from 1986 through 2011.

Escapement Methodology: The Makah Tribe and WDFW conduct ground surveys using cumulative redd counts for the mainstem (Hoko) and tributaries found between RM 1.5-21.7, which represents the entire range of spawning habitat utilized by Chinook salmon. Redd counts are multiplied by 2.5 adults/redd. There are 10 mainstem reaches plus 13 tributary reaches, including Little Hoko, Browne's, Herman, NF Herman, Ellis, Bear, and Cub rivers, which are all upper mainstem tributaries. The tribe also surveys the mainstem Sekiu and Carpenter, SF Carpenter, Sunnybrook, and unnamed creeks 19.0215, 19.0216, and 19.0218. Escapement excludes brood stock collected from the spawning grounds for the supplementation program which started in 1988 and has collected an average of 149 fish annually through 2011. In 2011, total natural spawning escapement was estimated to be 1,275 of mixed natural origin and returns from the supplementation program.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The UMT escapement goal established by state and tribal co-managers is 850 naturally spawning adults. This goal was developed as a proxy for the spawning escapement for MSY. The escapement goal was calculated using a habitat based approach rather than a stock-recruitment analysis by estimating the amount of available spawning habitat, then expanded utilizing assumed optimal redds per mile and fish per redd values (Ames and Phinney 1977).

2.4.3.2.2 Quillayute River Summer

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast.

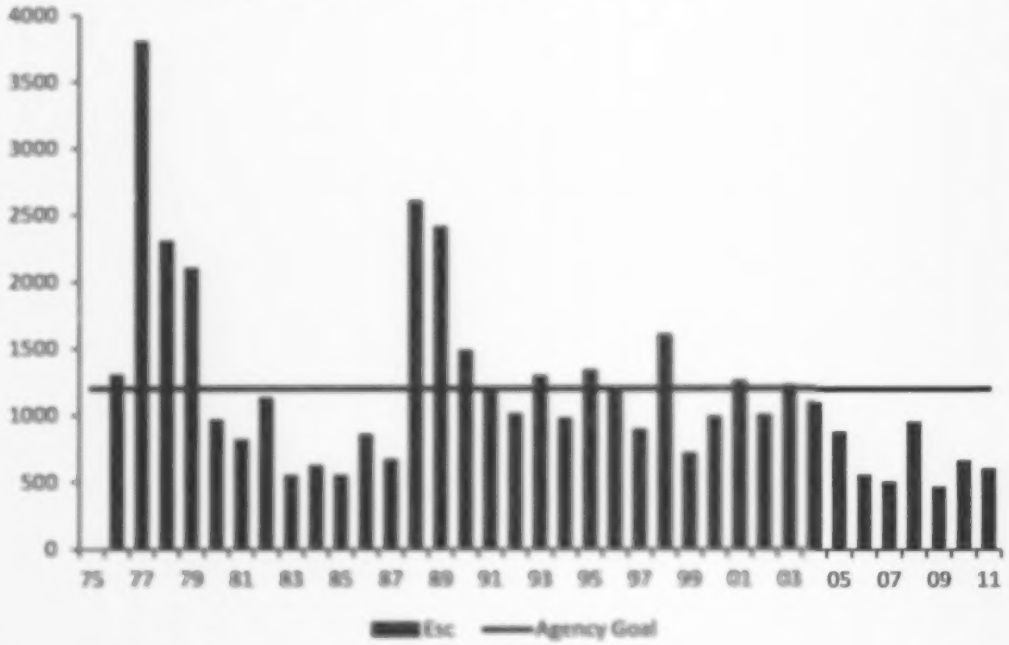

Figure 2.4.3.2.2Escapement of Quillayute River summer Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, mainstem Calawah, North Fork Calawah and Sitkum rivers. This has been used consistently in the Quillayute River System since the 1970's. Surveys are conducted by foot, raft, drift boat and helicopter. Surveys in index areas are examined either weekly or bi-weekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system "stream mileage base" that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2011 escapement estimate for summer Chinook salmon was 600 from a terminal run of 995.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state-tribal management goal for this stock is 1,200 adults and jacks combined (PFMC 2003).

2.4.3.2.3 Quillayute River Fall

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast. It is one of three Washington coast river systems that contain fall Chinook salmon with CTC approved escapement goals.

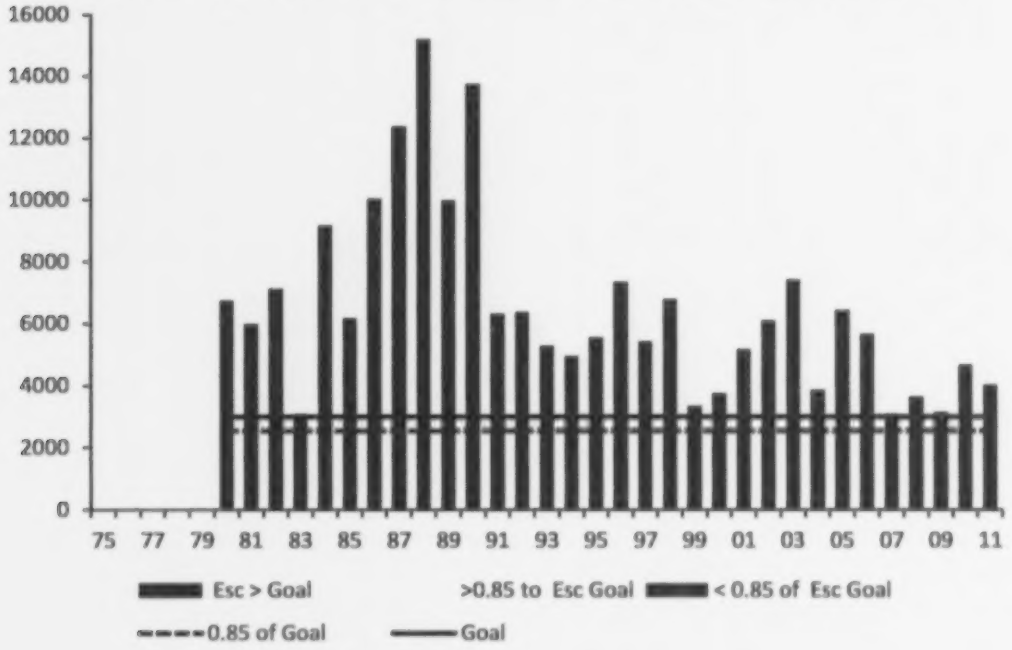

Figure 2.4.3.2.3 Escapement of Quillayute River fall Chinook salmon to the spawning grounds from 1980 through 2011.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, Sol Duc, Dickey, Calawah rivers and several other smaller tributaries in the basin. This has been used consistently in the Quillayute River System since the 1970's. Surveys are conducted by foot, raft, drift boat and helicopter. Surveys in index areas are examined either weekly or bi-weekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system "stream mileage base" that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2011 escapement estimate was 3,993, with a total terminal run estimate of 7,207.

Escapement Goal Basis: The CTC approved in 2004 the escapement goal for Quillayute fall Chinook salmon of 3,000 natural spawners based on spawner-recruit analysis developed by Cooney (1984) and QDNR (1982).

Agency Comments: Terminal fisheries are managed for a harvest rate of 40%, with an escapement floor of 3,000 fish (PFMC 2003). This objective is designed to actively probe at and above estimates of escapements that produce maximum sustained harvest (MSH), while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968-1982 were used to determine the initial escapement floor.

2.4.3.2.4 Hoh River Spring/Summer

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south.

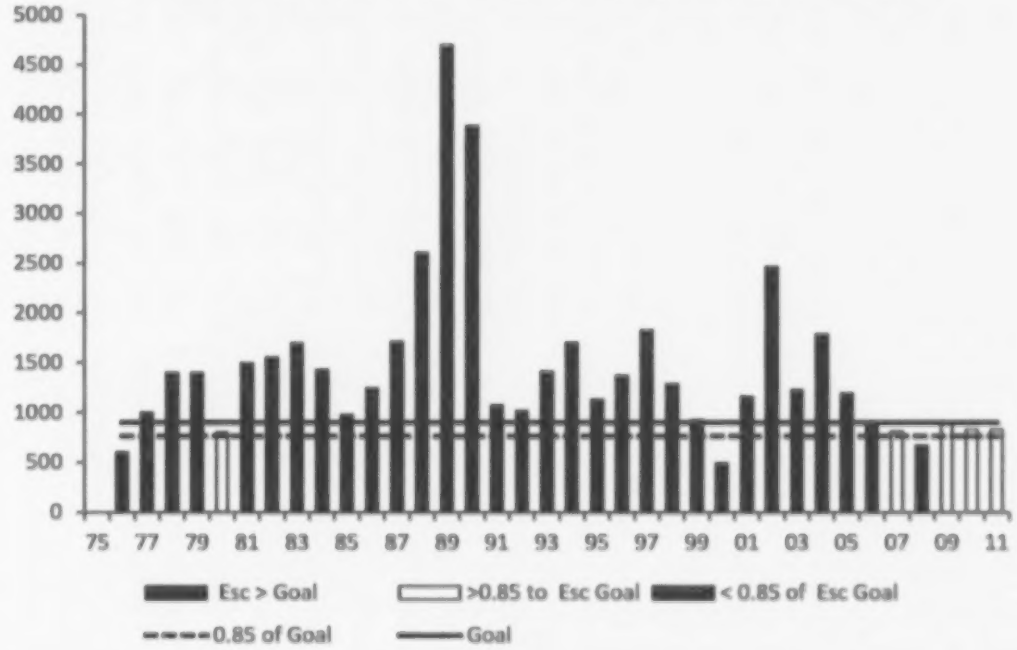

Figure 2.4.3.2.4Escapement of Hoh River spring/summer Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated from redd counts in index areas and supplemental surveys in the mainstem and south fork of the Hoh River and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record new and visible redds. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Surveys are also conducted in reaches too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity and spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5

fish/redd. There is no hatchery program in this system. The 2011 escapement estimate and total run size were 827 and 948 respectively.

Escapement Goal Basis: Escapement floor policy of 900 for the Hoh spring/summer Chinook salmon was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004.

Agency Comments: Similar to many of the other Washington coastal stocks, Hoh River spring/summer escapements have been relatively stable except for much larger returns in 1988, 1989, and 1990. The terminal return for this stock declined from 1997 to 2000, had rebounded in 2001 before declining again since 2005. Terminal fisheries are managed to catch 31% of the river run, with an escapement floor of 900 fish (PFMC 2003). This objective is designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock. Stock production analysis of spawning escapement for brood years 1969-1976 was utilized to determine the initial escapement floor.

2.4.3.2.5 Hoh River Fall

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south. It is one of three Washington coast river systems that contain fall Chinook salmon with CTC approved escapement goals.

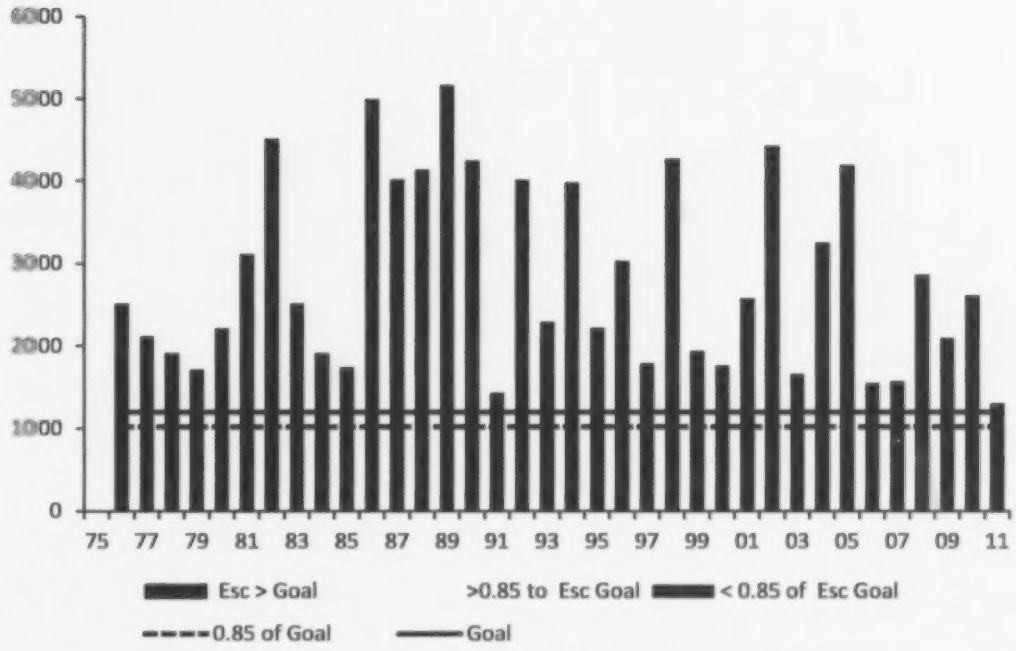

Figure 2.4.3.2.5Escapement of Hoh River fall Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated from redd counts in index areas and supplemental surveys in the mainstem and South Fork Hoh River and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The natural escapement estimates for Hoh River fall Chinook salmon include a small number of fish taken for an experimental hatchery program in 1983 to 1986, but otherwise should be considered natural origin fish. The 2011 escapement estimate was 1,293 fish. Terminal run estimate was 2,157.

Escapement Goal Basis: The escapement floor of 1,200 for the Hoh fall Chinook salmon was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal.

Agency Comments: The state-tribal management plan for this stock includes a harvest rate of 40% of the terminal run, with an escapement floor of 1,200 spawners (PFMC 2003). This objective is designed to actively probe at and above estimates of the escapements that produce MSH, while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968-1982 were utilized to determine the initial escapement floor.

2.4.3.2.6 Queets River Spring/Summer

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River.

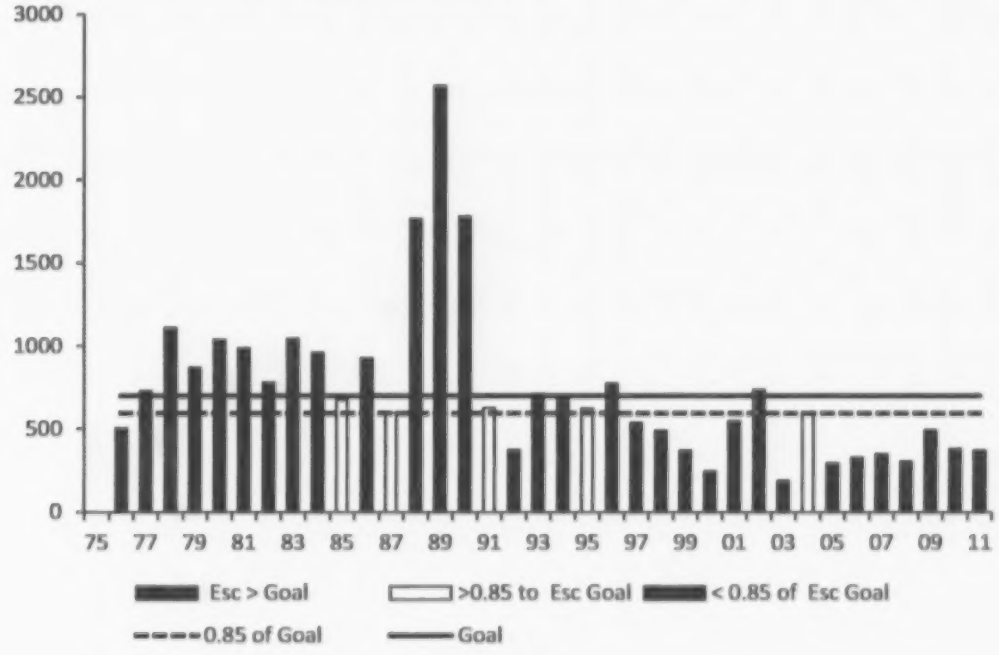

Figure 2.4.3.2.6Escapement of Queets River spring/summer Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated from redd counts during August 15 through October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing

curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2011 estimate of escapement and terminal return was 373.

Escapement Goal Basis: Escapement floor policy of 700 for Queets spring/summer Chinook salmon was developed by Cooney (1984) and QDNR (1982), based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal. Stock production analysis of spawning escapements for brood years 1969-1976 were used to determine the initial escapement floor.

Agency Comments: Terminal fisheries are managed by the state and tribes to catch 30% of the river run size, with an escapement floor of 700 fish (PFMC 2003). This objective is designed to actively probe at and above the estimates of escapement that produce MSH. Since 1990, terminal fisheries have had minimal impact on this stock as returns to the river have rarely exceeded the escapement floor. Since 2000, sport anglers have been required to release all Chinook salmon during the summer, and tribal fisheries have been limited to one tribal netting day for ceremonial and subsistence purposes.

2.4.3.2.7 Queets River Fall

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River. It is one of three Washington coast river systems that contain fall Chinook salmon with CTC approved escapement goals.

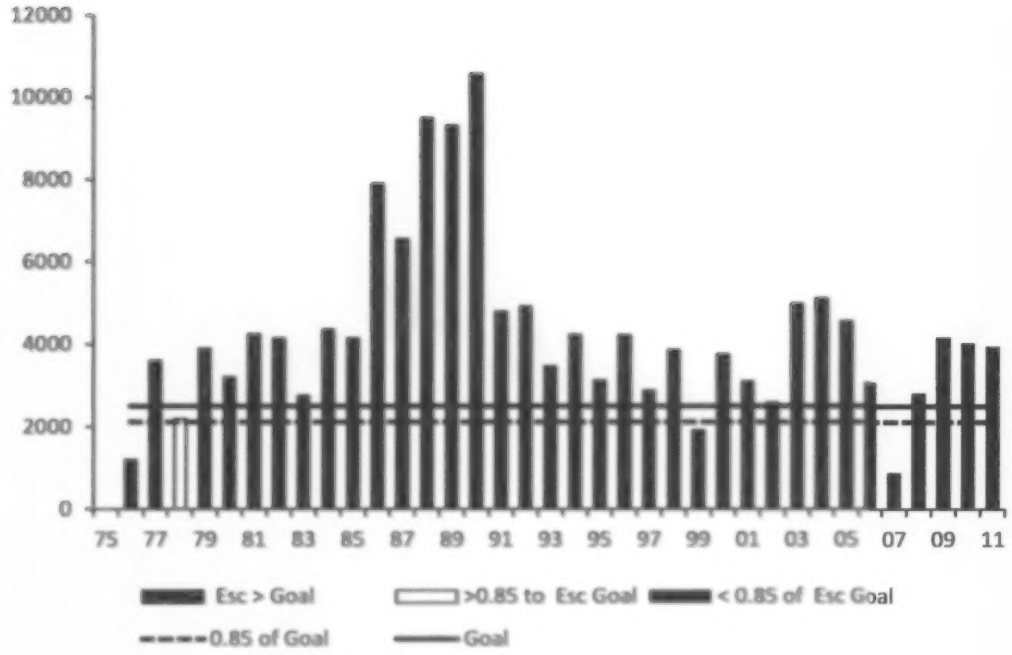

Figure 2.4.3.2.7Escapement of Queets River fall Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated from redd counts during October 15 through December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. For Queets River fall Chinook salmon, the 2011 escapement was 3,928 and the terminal run was 6,479.

Escapement Goal Basis: the escapement floor policy of 2,500 for the Queets fall Chinook salmon was developed by Cooney (1984) and QDNR (1982), and was based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal.

Agency Comments: Terminal fisheries are managed by the state and tribes to catch 40% of the river return, with an escapement floor of 2,500 spawners (PFMC 2003). This objective is designed to actively probe at and above estimates of the escapements that produce MSH. Stock production analyses of spawning escapements from 1967-1982 were used to determine the initial escapement floor.

2.4.3.2.8 Grays Harbor Spring

Grays Harbor spring Chinook salmon spawn primarily in the upper reaches of mainstem Chehalis River and its tributaries.

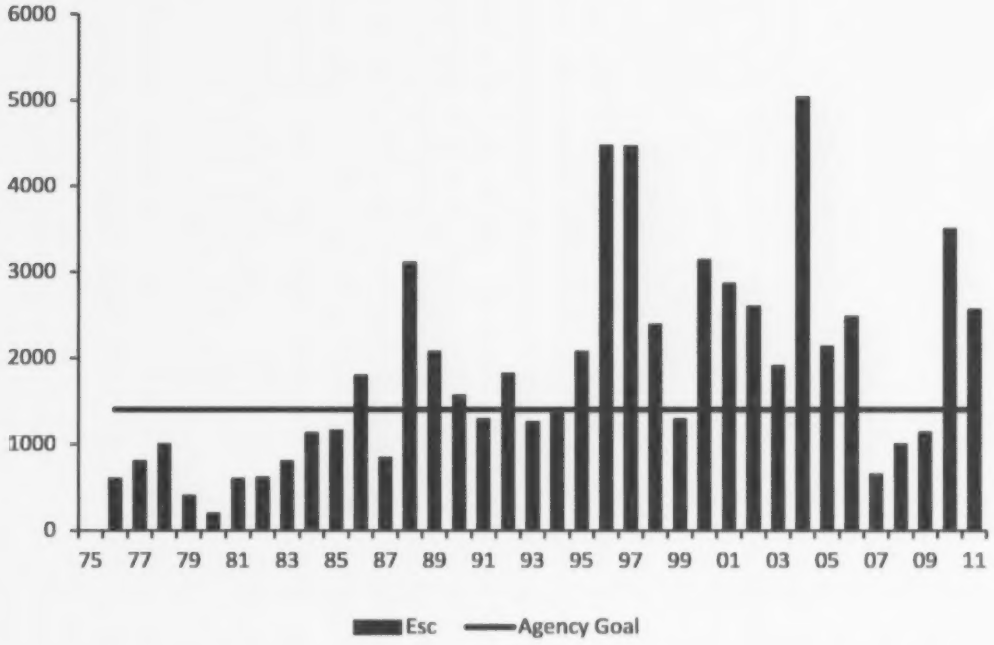

Figure 2.4.3.2.8Escapement of Grays Harbor spring Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated by redd counts during August 15 through October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative

redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2011 escapement was 2,563 Chinook salmon and the terminal run 2,664.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: The natural spawning escapement goal established by the state-tribal co-managers for Grays Harbor spring Chinook salmon is 1,400 adult fish (PFMC 2003). This single targeted goal was developed as a MSY proxy. This objective was derived from actual spawning data from the mid- to late 1970s, expanded to include additional habitat not covered by spawner surveys.

2.4.3.2.9 Grays Harbor Fall

Grays Harbor fall Chinook salmon spawn primarily in the mainstem Chehalis River, in the Humptulips River and Satsop rivers where fall Chinook salmon hatchery facilities are located and in smaller tributaries such as the Wishkah and Hoquiam rivers that flow directly into the harbor.

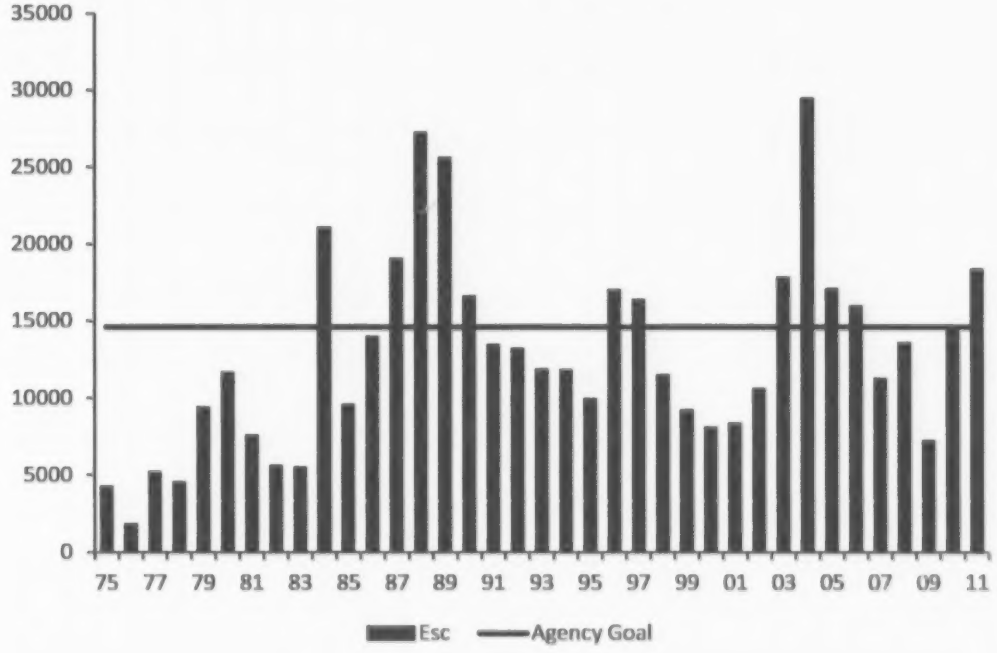

Figure 2.4.3.2.9Escapement of Grays Harbor fall Chinook salmon to the spawning grounds from 1976 through 2011.

Escapement Methodology: Escapement is estimated from redd counts during October 15 through December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and

helicopter. Intensively monitored index reaches are surveyed each week where surveyors record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted in non-intensively monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds/river mile) from surveyed reaches with similar habitat-type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish/redd. The 2011 escapement was 18,311 spawners from a terminal run of 26,553 Chinook salmon.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: The state-tribal escapement goal for Grays Harbor fall Chinook salmon is 14,600 spawners to the combined Chehalis and Humptulips Rivers (PFMC 2003). This single targeted goal was developed as an MSY proxy. The objective represents assumed optimal spawner density based on estimated available habitat.

2.4.3.3 Columbia River

Columbia River stocks include spring, summer, and fall Chinook salmon from the Columbia River and its tributaries. Runs may have markedly different marine distributions with different vulnerabilities to ocean fisheries. Upriver spring stocks generally migrate offshore and are rarely taken in ocean salmon fisheries. As a result, they are not identified as a PSC escapement indicator stock in Attachments I-V. Most summer and fall stocks have a northern distribution and are caught primarily in AABM fisheries. However, lower Columbia River tule fall Chinook salmon have a more local distribution and are caught mainly in the WCVI AABM fishery and US ISBM fisheries.

2.4.3.3.1 Columbia River Upriver Spring

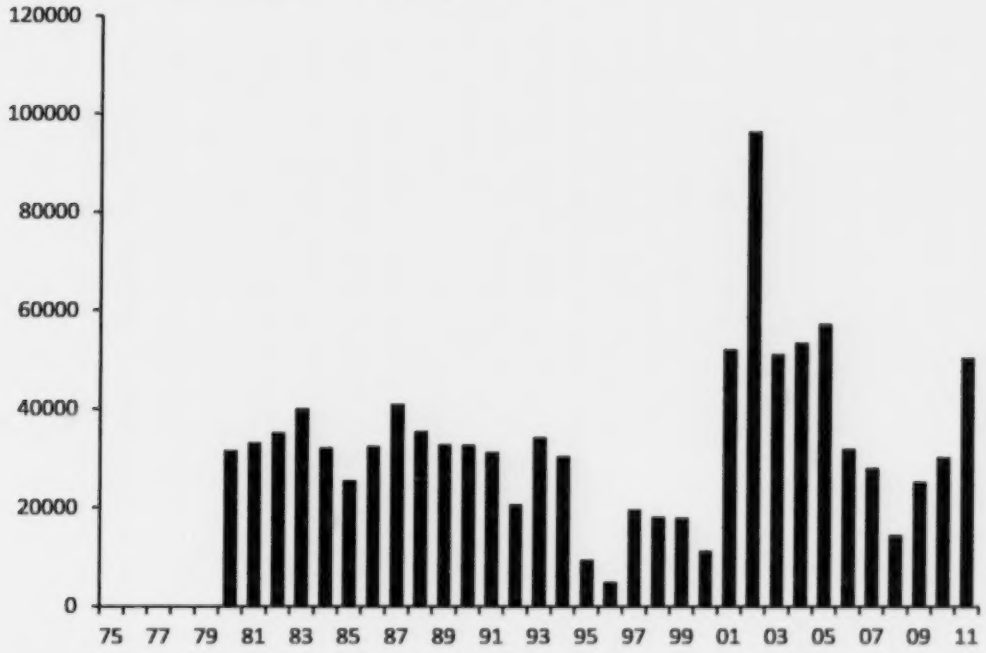

Figure 2.4.3.3.1Escapement of Columbia River upriver spring Chinook salmon, 1980 to 2011.

Escapement Methodology: The Columbia Upriver Spring Chinook salmon stock is an aggregate of Upper Columbia spring and Snake River spring/summer Chinook.. Historically, the run through Bonneville Dam was assessed through June 1. Following ESA listing of Snake River spring/summer Chinook salmon, the date was extended to June 15 so the listed stock could be managed under a more restrictive catch rate. Escapements were calculated as Bonneville Dam counts from January 1 through June 15, minus catches and incidental mortalities above Bonneville Dam, multiplied by the estimated proportion that spawn naturally, according to the Columbia River Technical Advisory Committee (CTAC) run reconstructions prepared for the biological assessment under the ESA.

Escapement Goal Basis: The interim management goal for Columbia River Spring Chinook was 115,000 hatchery and wild adult Chinook salmon counted at Bonneville Dam and 25,000 naturally-produced plus 10,000 hatchery-produced adults counted at Lower Granite Dam (CRFMP 1988). Under the 2008-2017 *U.S. v OR* Management Agreement, this stock is not managed for an escapement goal. Fishery impacts on natural origin fish are managed using a catch rate schedule ranging from 5.5% to 14.3% based on expected river mouth abundance (Table A1 of the 2008-2017 MA).

Agency Comments: The 2008-2017 *U.S. v OR* Management Agreement (MA) provides for a minimum annual mainstem treaty Indian Ceremonial and Subsistence entitlement of 10,000 spring and summer Chinook salmon. Beginning in 2010, modifications to Table A1 were implemented requiring non-Indian fisheries to meet catch balance provisions in the MA for upriver spring Chinook

salmon. Under these provisions, non-Indian fisheries are managed to remain within ESA impacts, and to not exceed the TAC available for treaty fisheries.

2.4.3.3.2 Columbia River Upriver Summer

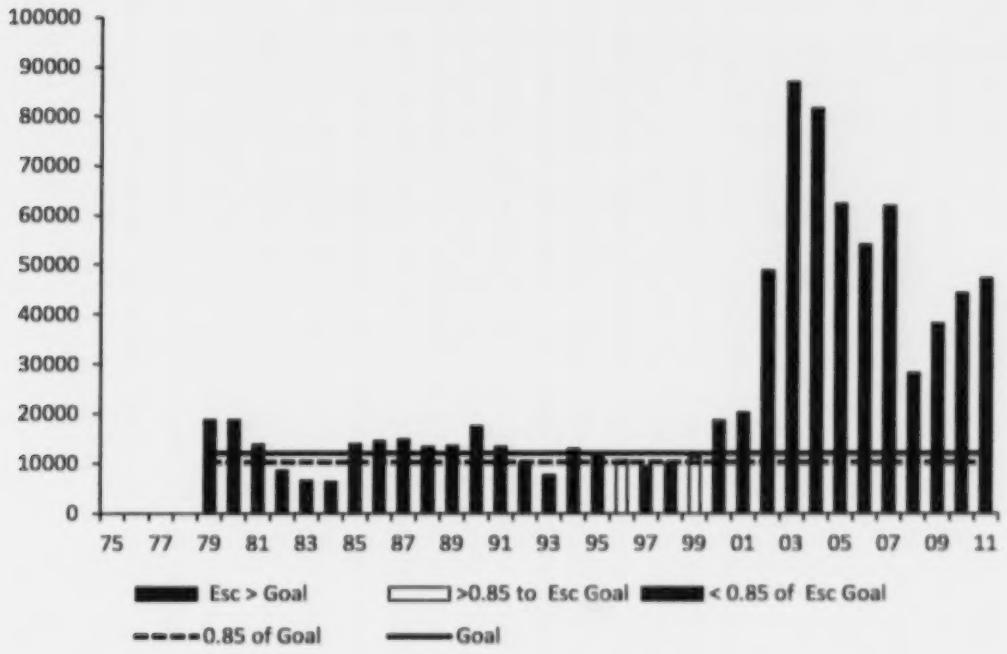

Figure 2.4.3.3.2Columbia River summer run Chinook escapements from 1979 to 2011.

Escapement Methodology: Graphed escapements are Rock Island Dam counts of all adult summer Chinook salmon for comparison to the interim escapement goal.

Escapement Goal Basis: The CTC (1999) developed an interim escapement goal of 12,143 summer Chinook salmon past Rock Island Dam, based on PSC Chinook salmon model data. Because model data used to develop the escapement goal included both hatchery and wild fish, the goal is not directly comparable to naturally spawning escapement estimates above Rock Island Dam. A revised analysis in 2008 using actual escapement data resulted in a similar goal, but modifications to the analysis were requested by the CTC and no action was taken.

Agency Comments: Columbia River summer Chinook salmon fisheries occur from June 16 through July 31, according to a catch rate schedule based on expected river mouth abundance. The schedule is provided in Table A2 of the 2008-2017 *U.S. v OR* MA. In addition, upper Columbia River summer Chinook are managed for a goal of 29,000 hatchery and natural origin adults, as measured at the Columbia River mouth. This management goal is based on an interim combined spawning escapement goal of 20,000 hatchery and natural adults, including the following three

components: 13,500 Wenatchee/Entiat/Chelan natural fish, 3,500 Methow/Okanogan natural fish and 3,000 hatchery fish.

2.4.3.3.3 Columbia River Upriver Bright

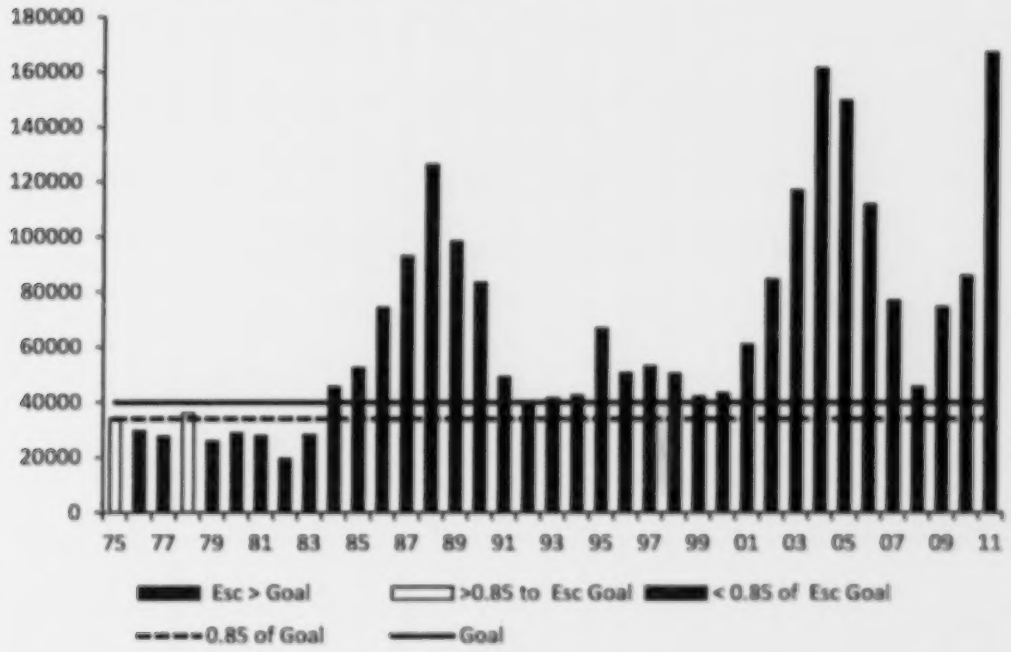

Figure 2.4.3.3.3 Columbia Upriver Bright Chinook escapements from 1975 to 2011.

Escapement Methodology: Escapement estimates are calculated as the McNary Dam count minus Hanford Reach adult sport catch, minus brood stock taken by Priest Rapids, Ringold and Snake River hatcheries.

Escapement Goal Basis: The CTC agreed escapement goal for Columbia River Upriver Bright Chinook is 40,000 naturally spawning fish past McNary dam based on stock-recruitment analyses.

Agency Comments: Under the 2008-2017 *U.S. v OR* Management Agreement, the minimum combined Columbia River and Snake River upriver bright management goal at McNary Dam is 60,000 adult fall Chinook salmon, which includes both hatchery and natural production for all areas above McNary Dam. The Parties also agreed to 43,500 as the minimum Upriver Bright adult escapement to meet the combined Hanford Reach, lower Yakima River, and mainstem Columbia River above Priest Rapids Dam natural spawning goal, as well as the current Priest Rapids Hatchery production (this historically included a minimal run to the Snake River).

2.4.3.3.4 Lewis River

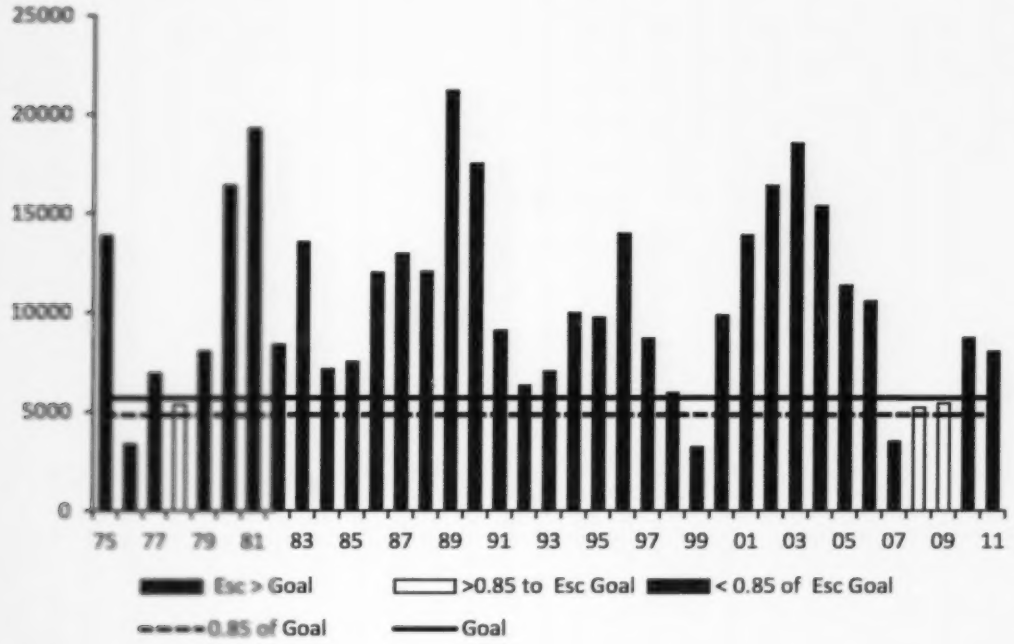

Figure 2.4.3.3.4Escapements of Lewis River fall Chinook salmon from 1975 to 2011.

Escapement Methodology: Most natural bright fall Chinook salmon production below Bonneville Dam occurs in the North Fork Lewis River. The Lewis River Wild stock is the main component of the Lower River Wild management unit for fall Chinook salmon, which also includes small amounts of wild production from the Cowlitz and Sandy River basins. In this report, the escapements and goal are for the Lewis River component. Annual escapement estimates are obtained by expanding peak counts from weekly counts of live and dead fish in the 6.4 km area below Merwin Dam (rkm 31.4) by a factor of 5.29 (total spawners/peak count).This factor was derived from a carcass tagging and recapture study performed in 1976 (McIsaac 1990). From 1999-2001, an LOA funded study estimated and verified the expansion factor. A CWT program for wild fish has been in place since the 1977 brood. Methods of CWT recovery, escapement counting, and expansion of the index area fish counts have been consistent since 1964. All naturally spawning adult fish, both from hatchery and natural production, are included in the escapement. The terminal run is escapement plus the adult sport catch in the Lewis River.

Escapement Goal Basis: The escapement goal of 5,700 fall Chinook salmon in the Lewis River was developed by McIsaac (1990), based on spawner-recruit analysis of the 1964-1982 broods and CWT recoveries from the 1977-1979 broods. This analysis was updated by the CTC (1999) using brood years 1964-1991 and the goal of 5,700 was accepted as a biologically-based goal.

Agency Comments: Lewis River escapements have been above their escapement goal since 1979, with the exception of 1999 and 2007 through 2009.

2.4.3.3.5 Deschutes River

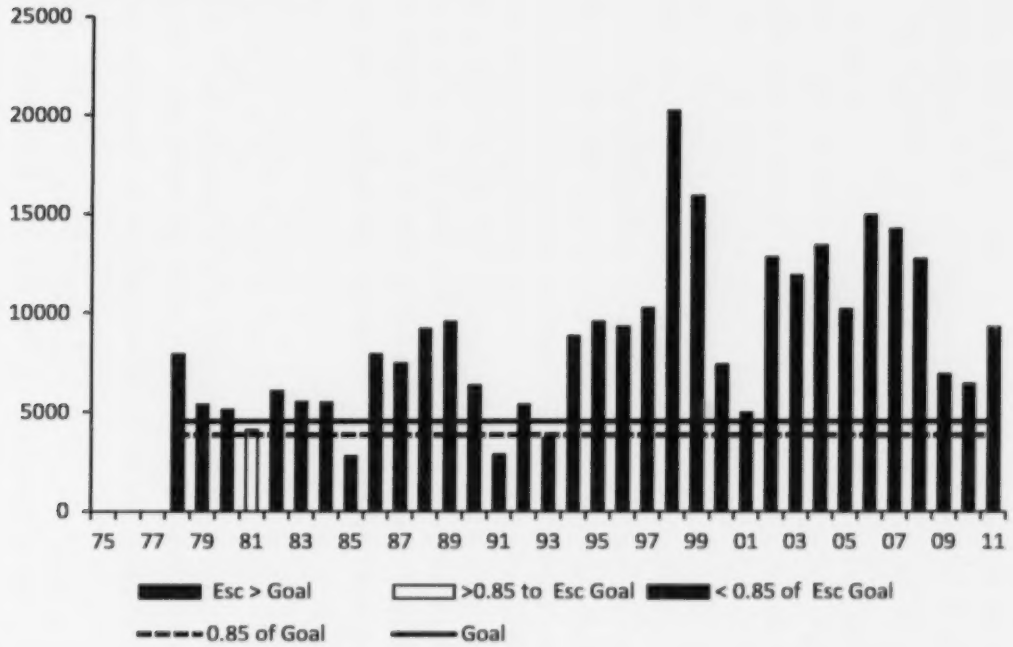

Figure 2.4.3.3.5Deschutes River fall Chinook escapements from 1977 to 2011.

Escapement Methodology: Escapement data are based on a MR estimate for the area above Sherars Falls and expanded for redd counts below Sherars Falls. From 2000 through 2007, Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) performed an entire river MR experiment to validate the Deschutes River fall Chinook escapement estimates. Results of these MR studies confirm the validity of the historical estimation methodology. For historic years where the entire river was not surveyed for redd counts, the time series was updated based on a comprehensive analysis done by Warm Springs, ODFW and Columbia River Intertribal Fish Commission (CRITFC) staff (Sharma et al. 2010). An escapement goal was derived from the updated time series and approved by the CTC. The metric reported above is the ODFW MR estimate based on expanding the Sherars Falls MR estimate for redds below Sherars Falls.

Escapement Goal Basis: The CTC-agreed escapement goal for Deschutes River fall Chinook salmon is 4,532 fish (Sharma et al. 2010).

Agency Comments: Deschutes River fall Chinook escapements have been maintained above the goal since 1992.

2.4.3.4 Coastal Oregon

2.4.3.4.1 Oregon Coastal North Migrating

Currently, only NOC fall Chinook salmon are accounted for in PSC management, while work is underway to include MOC production into the auspices of the PSC regime. The NOC production is bounded by the Necanicum on the north through the Siuslaw Basin on the south. After a period of precipitous declines in escapement during 2007, 2008 and 2009, the NOC stock aggregate has indicated signs of rebuilding to historical averages during the 2011 return year. There are three escapement indicator stocks representing the production of NOC Chinook salmon; the Nehalem, Siletz and Siuslaw stocks. The geographic range of production encompassed by the NOC includes 4 additional major basins, the Tillamook, Nestucca, Yaquina and Alsea. The Tillamook drainage system includes 5 sub-basins including the Kilchis, Miami, Trask, Wilson and Tillamook rivers. Total estimated spawning escapement in this aggregate has ranged from approximately 39,000 in 2008 to 190,000 in 1988. The ten-year (2001-2010) average for the NOC aggregate escapement is about 94,000. Estimated escapement in 2011 was 88,000. Abundance forecasts are expressed in terms of spawning escapement. Forecasted escapement for 2012 is 81,000. Forecasts for this aggregate are based on sibling-regression relationships developed for each discrete population, both indicator and non-indicator stocks. The aggregated forecast for the NOC is the sum of the forecasts for the individual basins within the geographic range. These methods were developed in 2008 and are continually refined with each year's additional information. Prior to 2008, the aggregate forecast (and each of the indicator stock's forecasts) was based on a running three-year average.

All three NOC escapement indicator stocks failed to achieve goals in both 2007 and 2008, and the Nehalem did not attain its goal in 2009 and 2010, but all three escapement indicator stocks exceeded CTC adopted goals in 2011 and are forecasted to reach or exceed their goals in 2012. Recent-year escapements in the southern range of the NOC (Siuslaw, Alsea) have shown encouraging rates of rebound, while their northern counterparts (Nehalem, Tillamook, Nestucca) have displayed a more protracted rebuilding pattern. Escapements in the middle of the NOC area have been observed to be steadily rebuilding.

Terminal fisheries management action, in concert with reductions in AABM fisheries, is contributing to the rebuilding of the NOC escapement. Terminal fisheries restrictions, which included closure in the Nehalem during 2009, have been adopted and maintained through 2011. Many of these restrictions were dropped for the 2011 return year in the southern extent of the geographic aggregate, but most have been retained or extended from those basins north of the Nestucca.

2.4.3.4.1.1 Nehalem River

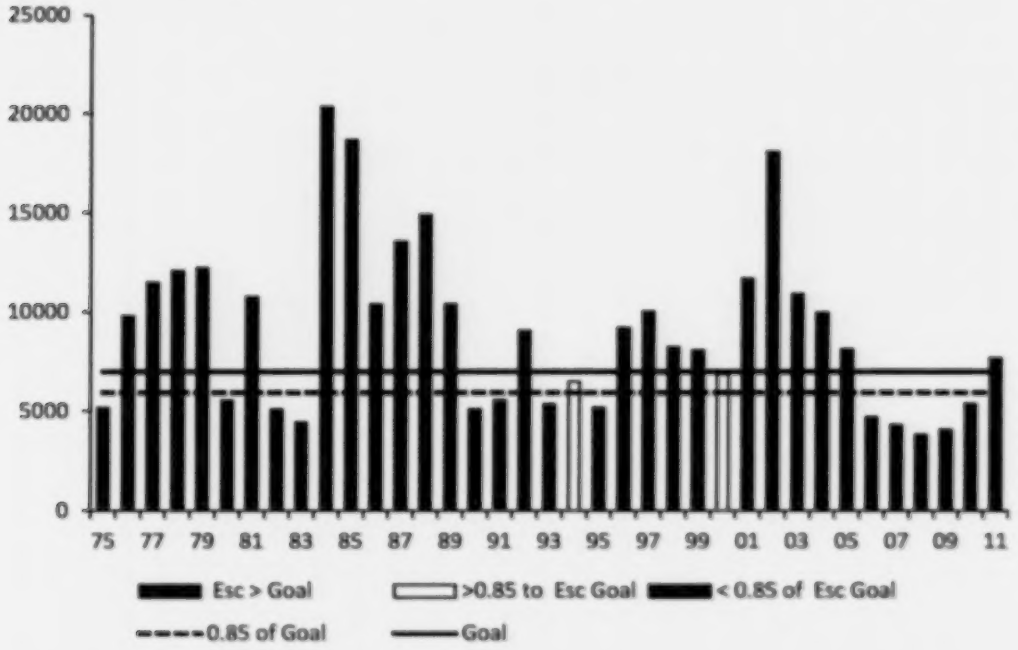

Figure 2.4.3.4.1 Nehalem River escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Both directed MR study and historically conducted surveys were used to measure escapement during the past return year. Standard estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then adjusted by estimates of the total available habitat, observer biases, the total run encountered during the peak, and the bias seen between these predefined surveys and those that are randomly selected.

Escapement Goal Basis: The current point goal of 6,989 spawners was derived by Zhou & Williams in 1999 and was based on assessments of escapement made through normative survey methodology.

Agency Comments: This stock is being studied by the Sentinel Stock Committee's program to improve escapement estimation. Direct MR adult spawner estimation indicated an escapement of 11,143 Chinook salmon in 2011. Methods comparable to those used to generate the agreed to escapement goal for the Nehalem indicate 2011 escapement of 7,665 adult spawners. This is 110% of the current escapement goal. This is the first return year since 2005 that Nehalem Chinook salmon have met their escapement goal. Due to continued failures to meet the escapement goal, the terminal sport fall Chinook salmon fishery in the Nehalem was closed in 2009. While a terminal sport fishery was conducted in both 2010 and 2011, significant area closures, daily and seasonal bag restrictions were deployed to assist in the rebuilding of this stock. A creel survey program is planned to estimate catches of this terminal sport fishery in 2012. Based on sibling-regression forecasting methods, the Nehalem is forecasted to meet the

escapement goal in 2012. ODFW is engaged in analysis to best use results from recent MR experiments to reconstruct historic estimates from peak-counts observed in standard surveys.

2.4.3.4.1.2 Siletz River Fall

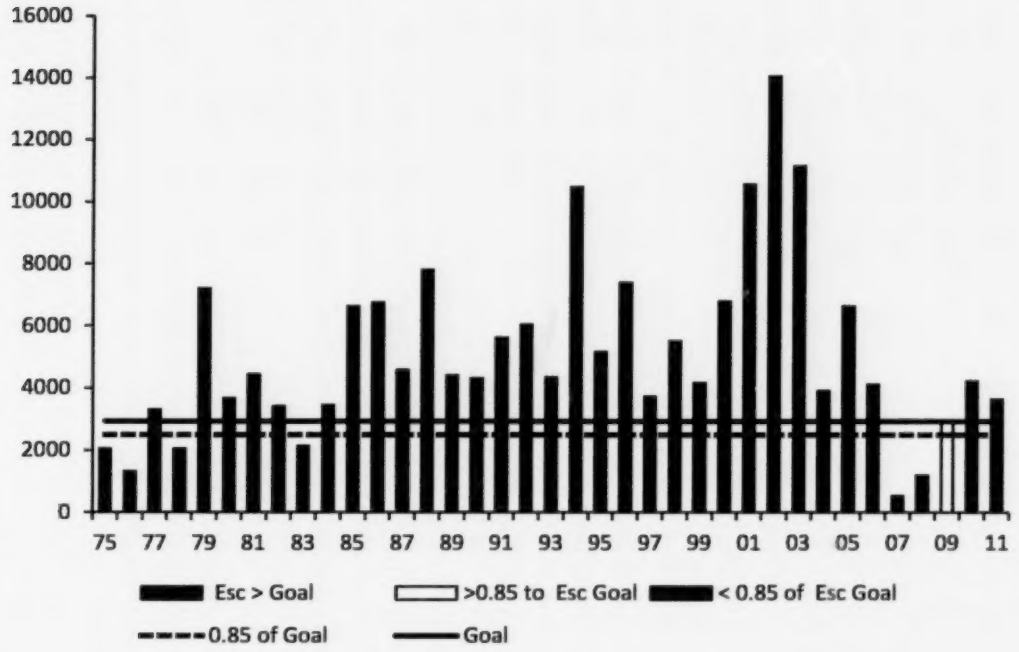

Figure 2.4.3.4.2 Siletz River fall escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Both directed MR study and historically conducted surveys were used to measure escapement during the past return year. Standard estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then adjusted by estimates of the total available habitat, observer biases, the total run encountered during the peak, and the bias seen between these predefined surveys and those that are randomly selected.

Escapement Goal Basis: The current point goal of 2,944 spawners was derived by Zhou & Williams in 2000 and was based on assessments of escapement made through standard survey methodology.

Agency Comments: This stock is being studied under the auspices of the Sentinel Stock Committee's program to improve escapement estimation. Calibration studies were initiated in the 2009 spawning year, thus traditional methods of escapement estimation remain in place until MR experiment-based estimation is complete. The MR study of escapement in the Siletz resulted in an independent estimate of 4,985 adult spawners in 2011. Data used to derive the escapement goal are not directly comparable to MR based estimates of escapement. The estimate based upon historically produced habitat expansion methods for 2011 was 3,638 adult fall Chinook salmon.

Significant terminal area sport fisheries restrictions which included substantial area closures, restrictive daily and seasonal bag limits are believed to have assisted in the achievement of the escapement goal. This stock is forecasted to exceed its escapement goal in 2012.

2.4.3.4.1.3 Siuslaw River Fall

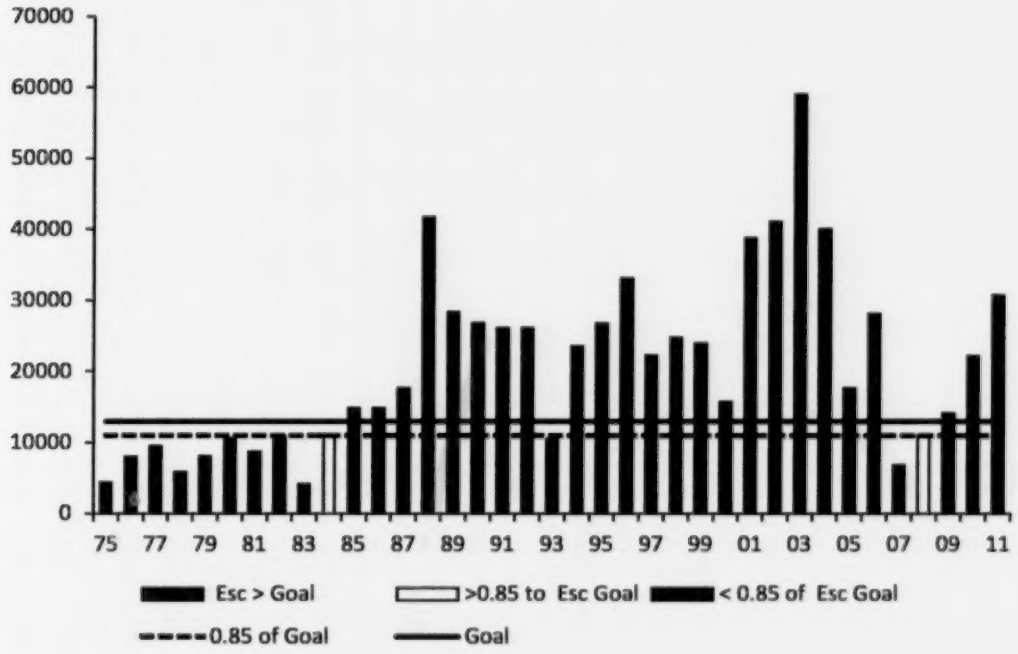

Figure 2.4.3.4.3 Siuslaw River fall escapements of Chinook salmon from 1975 to 2011.

Escapement Methodology: Both MR study based calibration factors and historically conducted surveys have been utilized to measure escapement during 2011. Standard estimates are generated from conducting surveys of peak abundance in historically walked predefined areas of known Chinook salmon spawning habitat within the basin. These observations are then adjusted by estimates of the total available habitat, observer biases, the total run encountered during the peak, and the bias seen between these predefined surveys and those that are randomly selected. A simple ratio comparison between MR-based estimates and observations of peak abundance in standard survey areas were used to generate a "calibrated" estimate.

Escapement Goal Basis: The current point goal of 12,925 spawners was derived in 2000 by Zhou and Williams (2001) and was based on assessments of escapement made through standard survey methodology.

Agency Comments: The estimated spawner abundance in 2011 was 7,436 adult Chinook salmon based on methods employing five years (2002-2006) of peak counts on six standard surveys calibrated to MR escapement estimates. The current escapement goal estimate was based upon

available habitat expansion escapement estimates, as used in other basins on the Oregon coast, but these estimates and goals were obviated through the improvement of estimation techniques based upon MR estimates. When escapement is estimated based on habitat expansion methods, the result is an estimate of 30,713 adult spawners. Spawner-recruit analysis utilizing the MR-based data set is planned for the near future to compare between newer escapement estimation (backcast through historical data-sets) and an escapement goal based upon the same data. This stock is forecast to exceed the escapement goal in 2012.

2.4.3.4.2 Mid Oregon Coast

The MOC aggregate has been proposed as an exploitation rate indicator stock, pending analysis and review of escapement goals for the South Umpqua and Coquille. The MOC aggregate is bounded by the Umpqua on the north through the Elk Basin on the south. After a period of precipitous declines in escapement during 2006 and 2007, the MOC stock aggregate has rebounded to historical levels during the 2010 and 2011 return years. The geographic range of production encompassed by the MOC includes two additional major basins, the Coos and Coquille. A smaller contributing basin, the Sixes, is located just north of the proposed exploitation rate indicator stock, the Elk River. Forecasts for this aggregate are based on sibling-regression relationships developed for each discrete population, both indicator and non-indicator stocks. These methods were developed in 2008 and are updated with each year's additional information.

2.4.3.4.2.1 South Umpqua River Fall

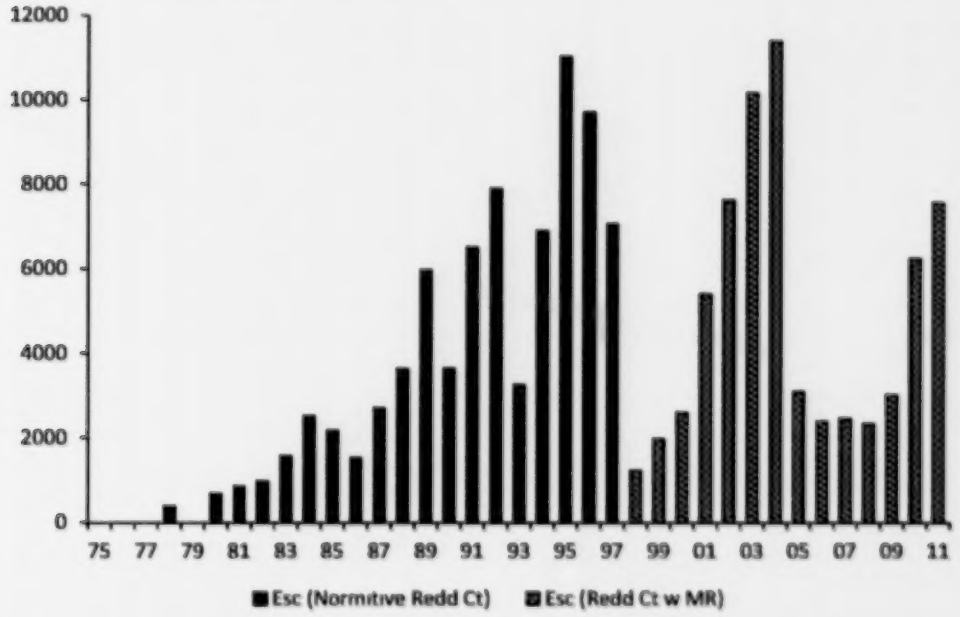

Figure 2.4.3.4.4Escapement of fall Chinook salmon to South Umpqua River, 1978 to 2011.

Escapement Methodology: Indices of Chinook salmon spawner abundance in the South Umpqua/Cow Creek sub-basin were derived from aerial redd-count surveys calibrated to six

years of MR study. The aerial surveys are funded by Douglas County and were conducted twice during the spawning season. Aerial redd counts were conducted on the lower 69 miles of the South Umpqua and the lower 60 miles of Cow Creek. These counts cover all mainstem spawning areas for fall Chinook salmon in the South Umpqua Basin. The South Umpqua is broken up into three reaches (Forks to Happy Valley, Happy Valley to Cow Creek, Cow Creek to Milo) and Cow Creek is considered as one reach from the confluence with the Umpqua River to Galesville Dam.

Aerial surveys are conducted using a Bell Ranger 3 helicopter; at least two flights are typically scheduled to encompass the peak spawning period. Two biologists simultaneously count redds for each reach using hand tally-counters. At the end of the reach, each biologist records the number of redds identified and counters are reset for the next reach. The average of the two observers' Chinook salmon redd counts from each reach is used. The index is defined as the sum of the observed average of the peak counts for each reach between the two flights. Expansions are sometimes made to account for portions of reaches that were not completed due to visibility or mechanical problems.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Recoveries of coded-wire tagged fall-run Chinook salmon from the Umpqua River indicate that they are caught in PSC fisheries. Four years of U.S. CTC-funded research has allowed the calibration of redd counts to derive a fish-per-redd expansion factor to estimate annual escapements. The average expansion factor from these studies is 3.64 fish per redd. The coefficient of variation (CV) of the expansion factor was found to be 29%, which indicates that the average expansion factor is a reasonably reliable statistic to use for annual estimates of escapement. The escapement estimate for 2011 was 7,550 adults based on redd-count expansions.

Terminal run estimation is currently being conducted and will require some measure of data mining in order to reconstruct historic terminal catch. Preliminary indications are that the terminal catch of South Fork Umpqua Chinook salmon is insubstantial.

2.4.3.4.2.2 Coquille River Fall

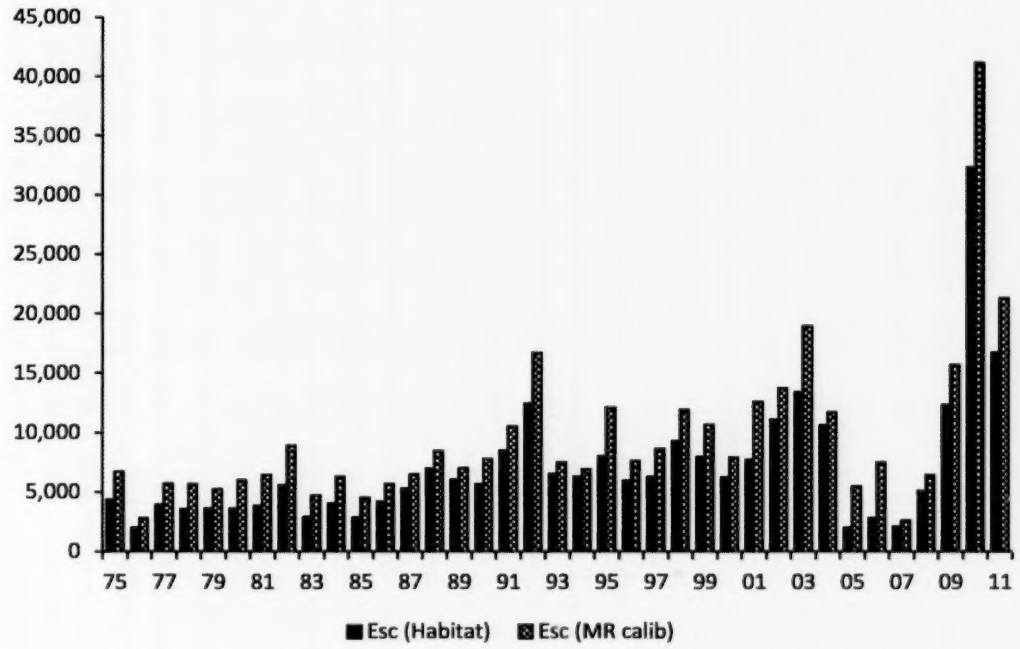

Figure 2.4.3.4.5Escapement of fall Chinook salmon to Coquille River, 1975 to 2011.

Escapement Methodology: Both MR study based calibration factors and historically conducted surveys were used to measure escapement during the past return year. Standard survey methods are identical to those described in the Siuslaw, Siletz and Nehalem basins. A simple ratio comparison between those years of MR based estimates and observations of peak abundance in standard survey areas have been used to generate a "calibrated" estimate. Values presented in the above graph are based on standard survey estimations, not the calibrated values. Both standard and MR calibrated estimates may be found in the appendix tables.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Methods of estimation based on MR-calibrated analysis indicate an adult Chinook salmon escapement for the Coquille Basin of 21,291 spawners in 2011. Habitat-expansion based estimates indicate an escapement of 16,745 adult fish. Analysis funded by the CTC is underway that will provide information to designate Coquille Fall Chinook salmon as an escapement indicator stock for the Mid-Oregon Coast (MOC) Aggregate. An index of peak counts from standard surveys calibrated to MR abundance estimates has been selected as an efficient and cost-effective means to measure spawner escapement of Chinook salmon for use in PST fisheries management.

The U.S. CTC recommends that a CV of <30% should be achieved in order for an index to be used as an estimator of abundance within the Chinook salmon management scheme. The CV

between the qualifying calibration values computed from studies conducted from 2001 through 2004 for the Coquille River basin is 14%, and the average index value of 0.00874. This analysis includes eight standard surveys conducted annually on a regular basis. The calibration value is defined as the average peak count per mile of the eight standard surveys divided by the point value of the Petersen estimate. Peak count is defined as the largest sum of live Chinook salmon and carcasses observed on a particular day, per mile over a defined survey reach.

Improvements in applying those calibrated values towards the estimation of this and other Oregon Coastal stocks are currently being discussed within the agency. It is anticipated that historical time series for each of the basins which have MR calibration studies (Nehalem, Siletz, Siuslaw, Coquille) will be updated once consensus is reached and finalized by the next reporting cycle.

3 SENTINEL STOCKS PROGRAM

3.1 Introduction

During recent negotiations within the Pacific Salmon Commission to amend the current Chinook salmon regime under Chapter 3, Annex IV of the Pacific Salmon Treaty, it became apparent that the accuracy and precision of spawning escapement estimates for many important natural stocks of Chinook salmon may not be adequate to support the Treaty management process. Reliable estimates of spawning escapements for a large number of natural Chinook salmon stocks over time are critical to assessing and monitoring the status of the resource throughout the Treaty area, as well as to determining whether adjustments to particular fisheries are necessary and effective for achieving the long term conservation and production goals of the Treaty.

Recognizing the importance of better estimates of Chinook salmon spawning escapements, the Commission conceived the five-year Sentinel Stock Program (SSP) and included it as a specific requirement in the revised Chinook salmon regime (see Paragraph 3(a) of Chapter 3, Annex IV). The SSP is intended to focus on improving spawning escapement estimates for a select subset of important natural Chinook salmon stocks for which existing estimates are critical to fishery management decisions required by the Chinook salmon regime. Improving these estimates will bolster the scientific basis of the Chinook salmon regime, increase confidence in management decisions required under the new regime, and better inform the development of future regimes.

The goal of the Sentinel Stocks Program is to improve estimates of the spawning escapements for each of the included stocks to a level that meets or exceeds bilateral assessment accuracy and precision standards. Twelve projects were funded by the SSP in 2011, the third year of the SSP. Summaries for each project are reported in Appendix C.

3.1.1 Oregon

3.1.1.1 Nehalem

The spawning escapement, 11,084 (CV = 14%) was estimated using mark-recapture methods. Returning fish were captured by using nets and weirs and then marked with opercular punches. Subsequent carcass surveys were used to recover marked and unmarked fish from the spawning

grounds. A creel survey was also conducted to both identify instances when marked fish were removed from the system and to generate timely and robust estimates of terminal harvest.

3.1.1.2 Siletz

This mark-recapture program relied on nets and weirs to capture returning fish in the lower river, which were then marked with opercular punches. Carcasses were examined for marks at the spawning grounds. A creel survey was also conducted to estimate removals of marked fish by the terminal sport fishery, and estimate the terminal harvest. The preliminary spawning escapement was estimated at 4,985 Chinook salmon (CV = 7%).

3.1.2 Puget Sound

3.1.2.1 Green

The abundance of Chinook salmon spawning in the Green River in 2010 was estimated using genetic based Lincoln-Peterson mark-recapture abundance estimators (GMR). Spawning adults were 'marked' by obtaining a DNA microsatellite profile from tissue sampled from adult carcasses. Marks were later 'recaptured' by sampling out-migrating smolts ('captures') and genetically identifying some fraction of marks as parents of some out-migrating offspring. The preliminary adjusted estimate of Chinook salmon total spawner abundance expanded to include the river area below the smolt trap was 4,541 (CV = 9.5%).

3.1.2.2 Stillaguamish

The abundance of Chinook salmon spawning in the Stillaguamish River in 2010 was estimated using GMR methods. Spawning adults were 'marked' by obtaining a DNA microsatellite profile from tissue sampled from adult carcasses. Marks were later 'recaptured' by sampling out-migrating smolts ('captures') and genetically identifying some fraction of marks as parents of some out-migrating offspring. Unmarked hatchery juveniles presented some challenges to the program, and the preliminary GMR results presented include corrections for unmarked hatchery juveniles and yearlings. The preliminary estimate of Chinook salmon spawner abundance was 1,381 (CV = 15%). Similar methods were used with archived data to estimate total escapement in the years 2007, 2008, and 2009; details concerning these years can be found in Appendix C.

3.1.3 WCVI

3.1.3.1 Moyeha

An investigation was conducted to determine if it was feasible to undertake mark-recapture studies to estimate Chinook salmon escapement to the Moyeha River. Seine, angling, and tangle net capture techniques were employed and external marks applied, however, capture rates and population size were insufficient to provide enough marks for mark-recapture studies.

3.1.3.2 Kaouk

In 2011, a project was conducted to assess the escapement of adult Chinook salmon returning to the Kaouk River, using mark-recapture methods. Due to temporal and spatial overlap of the mark and recovery events, and the inability to sample fish in September and October due to high water levels, a reliable mark-recapture estimate could not be generated. An estimate was

generated using area-under-the-curve methods based on swim surveys; the estimated escapement of adult Chinook salmon to the Kaouk River was 256 fish.

3.1.3.3 Burman

This SSP project estimated spawning escapement (5,384 Chinook salmon; CV = 14%) using mark-recapture methods. Returning fish were captured with beach seines in the lower river and then tagged and released. Carcasses were recovered upstream at the spawning grounds and examined for tags.

3.1.4 Fraser

3.1.4.1 South Thompson River

Spawning escapement to the South Thompson Age 0.3 aggregate will be estimated using a combination of genetic, scale age, and CWT information collected from the Northern BC troll fishery and Albion (Fraser River) gillnet test fishery, along with CWT information collected at the Lower Shuswap River. A Bayesian estimation model will be used to estimate escapement while considering uncertainty in these information sources. Genetic samples collected at Albion have now been processed and analyses to determine an estimate of aggregate escapement are expected to commence in late May 2012. The 2011 escapement will be reported in next year's CTC Catch and Escapement report.

3.1.4.2 Chilko River

The 2011 escapement of Chinook salmon to the Chilko River (8,396, CV = 5%) was estimated using a two event mark-recapture study, and concurrent aerial visual surveys. Petersen tags and sex-specific secondary marks were applied to returning salmon and recovery sampling was undertaken on carcasses.

3.1.5 Northern BC

3.1.5.1 Skeena River

The escapement of summer timed Chinook salmon to the Skeena River in 2011 was estimated at 48,125 fish (CV = 21.4%). Genetic analysis of representative samples collected at the Tyee test fishery and the spawning abundance in the Kitsumkalum River were used to generated the estimate. The SSP funded the genetic analysis of the test fishery samples in order to identify fish originating from the Kitsumkalum River. The Kitsumkalum Chinook escapement was estimated from an independent mark-recapture project. The Kitsumkalum escapement estimate was expanded to an estimate for the aggregate of Skeena River summer timed Chinook salmon using the proportion of Chinook identified as Kitsumkalum in the Tyee Test fishery catch.

3.1.5.2 Skeena River Retrospective Analysis

In 2011, historical escapements to the Skeena River were investigated using similar techniques to those described above. DNA was extracted from archived Tyee test fishery scale samples and analyzed to determine stock composition, and the ratios of fish of Kitsumkalum River origin. Escapement estimates were generated for 12 previous years between 1985 and 2005. Estimated

escapements to the Skeena ranged from 37,893 (CV = 15.9%) to 150,451 (CV = 17.4%). The escapement estimates and associated CV's are presented in Appendix Table C.9.

3.1.5.3 Nass River

This SSP project was part of a larger basin-wide escapement program where Chinook salmon were captured and tagged at fishwheels in the lower Nass River and then recovered and examined for marks at upstream tributaries to generate a mark-recapture estimate. The SSP partly funded fishwheel operations and funded the operation of a counting fence on the Kwinageese River and carcass surveys on the Damdochax River. The total spawning escapement estimate was only 9,639 Chinook salmon; the second lowest return recorded since the fishwheel program was initiated in 1994.

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Appendix A.1 Southeast Alaska Chinook salmon catches.

Year	Southeast Alaska						
	Troll	Net	Sport	Total	Add-on	Terminal Exclusion	Treaty Catch
1975	287,342	13,365	17,000	317,707	-	-	-
1976	231,239	10,523	17,000	258,762	-	-	-
1977	271,735	13,443	17,000	302,178	-	-	-
1978	375,919	25,492	17,000	418,411	-	-	-
1979	337,672	28,388	16,581	382,641	-	-	-
1980	303,643	20,114	20,213	343,970	-	-	-
1981	248,782	18,952	21,300	289,034	-	-	-
1982	241,938	46,992	25,756	314,686	-	-	-
1983	269,821	19,516	22,321	311,658	-	-	-
1984	235,622	32,405	22,050	290,077	-	-	-
1985	215,811	33,870	24,858	274,539	6,246	-	268,293
1986	237,703	22,099	22,551	282,353	11,091	-	271,262
1987	242,562	15,532	24,324	282,418	17,095	-	265,323
1988	231,364	21,788	26,160	279,312	22,525	-	256,787
1989	235,716	24,245	31,071	291,032	21,510	-	269,522
1990	287,939	27,712	51,218	366,869	45,873	-	320,996
1991	264,106	34,864	60,492	359,462	61,476	-	297,986
1992	183,759	32,140	42,892	258,791	36,811	-	221,980
1993	226,866	27,991	49,246	304,103	32,910	-	271,193
1994	186,331	35,654	42,365	264,350	29,185	-	235,165
1995	138,117	47,955	49,667	235,739	58,800	-	176,939
1996	141,452	37,298	57,509	236,259	72,599	8,663	154,997
1997	246,409	25,069	71,524	343,002	46,463	9,843	286,696
1998	192,066	23,514	55,013	270,593	25,021	2,420	243,152
1999	146,219	32,720	72,081	251,020	47,725	4,453	198,842
2000	158,717	41,400	63,173	263,290	74,316	2,481	186,493
2001	153,280	40,163	72,291	265,734	77,287	1,528	186,919
2002	325,308	31,689	69,537	426,534	68,164	1,237	357,133
2003	330,692	39,374	69,370	439,436	57,228	2,056	380,152
2004	354,658	64,038	80,572	499,268	75,955	6,295	417,019
2005	338,446	71,618	86,575	496,639	65,294	39,346[1]	391,999[1]
2006	282,315	70,384	85,794	438,493	49,111	26,434[1]	362,948[1]
2007	268,149	55,884	82,848	406,881	69,647	7,431[1]	329,804[1]
2008	151,936	46,149	49,265	247,350	68,163	5,805[1]	173,382[1]
2009	175,644	54,250	69,565	299,459	65,189	3,623[1]	230,647[1]
2010	195,494	33,531	58,503	287,528	55,816	121	231,591
2011	242,185	56,074	60,538[2]	358,797	67,384	698	290,715

Troll, net, sport and total catches include catch of Southeast Alaska hatchery-origin fish and terminal exclusion catch; catches that count towards the all-gear ceiling (with hatchery add-on and terminal exclusion subtracted) are shown in the "treaty catch" column. "-" = not applicable.

[1] Values changed because terminal exclusion is now calculated only for statistical weeks 17-29 and the sport terminal exclusions are now calculated using GSI instead of CWTs.

[2] Preliminary value until mail-out survey results are available.

Appendix A.2Northern British Columbia (NBC) Chinook salmon catches.

Year	Northern British Columbia						
			Tidal Sport				
	Area 1-5 Troll[1,2]	Area 1-5 Net[2]	Areas 1,2E, 2W	Areas 3-5	Area 1-5 Freshwater Sport	Area 1-5 First Nations	Total
1975	228,121	25,095	NA	NA	NA	4,055	257,271
1976	190,267	16,105	NA	NA	NA	2,791	209,163
1977	130,899	44,196	106	1,670	2,158	6,998	186,027
1978	146,054	27,924	125	1,668	6,610	5,363	187,744
1979	147,576	40,640	0	2,523	1,960	5,266	197,965
1980	157,198	26,895	200	3,867	4,515	10,121	202,796
1981	153,065	41,724	184	2,760	2,613	11,115	211,461
1982	173,472	44,844	215	3,760	2,726	13,255	238,272
1983	162,837	17,134	90	4,092	5,374	15,532	205,059
1984	185,134	31,321	171	2,300	3,426	11,408	233,760
1985	165,845	39,562	600	3,600	3,186	15,794	228,587
1986	175,715	23,902	1,153	3,950	4,410	24,448	233,578
1987	177,457	18,357	2,644	4,150	3,625	16,329	222,562
1988	152,369	31,339	7,059	4,300	3,745	21,727	220,539
1989	207,679	38,623	20,652	4,150	5,247	21,023	297,374
1990	154,109	28,359	16,827	4,300	4,090	27,105	234,790
1991	194,018	40,899	15,047	4,256	4,764	23,441	282,425
1992	142,340	35,716	21,358	6,250	6,182	27,012	238,858
1993	161,686	33,944	25,297	3,279	7,813	21,353	253,372
1994	164,581	22,032	28,973	3,171	3,093	15,949	237,799
1995	56,857	18,076	22,531	2,475	3,503	13,635	117,077
1996	8	33,080	670	3,382	1,250	13,345	51,735
1997	84,385	22,355	27,738	0	NA	14,610	149,088
1998	117,147	7,833	34,130	4,750	NA	20,622	184,482
1999	44,900	11,387	30,227	11,700	NA	27,399	125,613
2000	9,948	22,849	22,100	8,600	NA	23,476	86,973
2001	13,351	25,410	30,400	11,000	NA	23,508	103,669
2002	103,021	15,211	47,100	8,000	NA	14,125	187,457
2003	139,862	15,230	54,300	NA	5,711[3]	20,950	287,454
2004	169,306	12,305	74,000	NA	NA	20,548	276,159
2005	174,806	6,850	68,800	NA	NA	17,553	268,009
2006	151,485	12,561	64,500	NA	NA	17,262	245,808
2007	83,235	10,079	61,000	NA	NA	14,087	168,401
2008	52,147	5,938	43,500	11,970	NA	14,963	128,518
2009	75,470	3,083	34,000	9,177	NA	13,083	134,813
2010	90,213	3,141	46,400	7,570	2,689	13,693	163,706
2011	74,660	3,586	48,000	14,677	2,540	10,863	154,326

[1] Since 1998, the catch accounting year for troll fisheries was set from Oct 1-Sept 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.
[2] Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

Estimate of lower Skeena River sport catch only. Note that troll (Areas 1-5) and tidal sport (Areas 1, 2E, 2W) are the components of the Northern British Columbia Aggregate Abundance Based Management fishery. Net catch excludes jacks and small red-fleshed Chinook salmon.

Appendix A.3Central British Columbia Chinook salmon catches.

Year	Central British Columbia					
	Troll[1,2]	Net[2]	Tidal Sport[3]	Freshwater Sport	First Nations	Total
1975	135,470	40,985	NA	NA	NA	176,455
1976	145,204	32,669	NA	NA	NA	177,873
1977	122,689	32,409	4,773	1,544	6,972	168,387
1978	91,025	35,708	5,694	1,770	7,944	142,141
1979	107,884	50,445	5,225	1,940	7,585	173,079
1980	95,377	27,715	4,802	988	6,240	135,122
1981	69,247	18,912	3,490	1,261	5,701	98,611
1982	69,748	32,419	5,419	1,293	9,112	117,991
1983	97,447	12,556	4,271	821	6,442	121,537
1984	78,120	4,630	4,354	1,332	9,736	98,172
1985	27,090	12,391	3,943	823	6,019	50,266
1986	54,407	23,032	4,566	1,245	6,353	89,603
1987	65,776	10,893	3,933	1,563	6,296	88,461
1988	36,125	12,886	3,596	1,496	6,000	60,103
1989	21,694	6,599	3,438	4,526	8,992	45,249
1990	29,882	18,630	4,053	5,626	9,811	68,002
1991	29,843	15,926	4,409	3,335	8,801	62,314
1992	47,868	18,337	4,891	3,204	8,533	82,833
1993	23,376	10,579	6,114	2,880	9,095	52,044
1994	18,976	14,424	4,303	973	5,383	44,059
1995	5,819	11,007	2,172	1,180	3,501	23,679
1996	0	7,201	2,936	3,986	6,922	21,045
1997	9,274	3,650	8,524	1,139	9,764	32,351
1998	2,188	5,467	5,514	779	6,671	20,619
1999	2,073	4,342	10,300	NA	5,440	22,155
2000	0	3,197	7,400	NA	4,576	15,173
2001	482	6,465	7,650	1,024	5,435	21,056
2002	0	4,676	7,330	723	3,292	16,021
2003	0	2,815	8,385	491	3,173	14,864
2004	0	5,404	10,677	524	4,003	20,608
2005	0	6,323	9,017	809	4,180	20,329
2006	0	5,231	9,400	NA	4,013	18,644
2007	0	5,542	6,130	522	2,102	14,296
2008	9	1,133	2,909	276	3,018	7,345
2009	0	3,132	3,239	0	4,011	10,382
2010	0	1,549	4,043	NA	3,710	9,302
2011	0	4,794	7,701	646	2,323	15,464

[1]Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2]Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project net catch excludes jacks and small red-fleshed Chinook salmon.

[3]Freshwater catch included with tidal catch.

Appendix A.4West Coast Vancouver Island Chinook salmon catches.

Year	West Coast Vancouver Island						
			Tidal Sport	Tidal Sport			
	Troll[1,2,3]	Net[3]	Inside[4]	Outside	Freshwater Sport	First Nations[5]	Total
1975	546,214	19,233	NA	-	NA	NA	565,447
1976	665,010	17,492	NA	-	NA	NA	682,502
1977	545,742	13,745	NA	-	NA	NA	559,487
1978	568,705	25,143	NA	-	NA	NA	593,848
1979	477,222	35,623	7,964	-	NA	NA	520,809
1980	486,303	34,732	8,539	-	NA	NA	529,574
1981	423,266	36,411	11,230	-	NA	NA	470,907
1982	538,510	41,172	17,100	-	NA	NA	596,782
1983	395,636	37,535	28,000	-	NA	NA	461,171
1984	471,294	43,792	44,162	-	NA	NA	559,248
1985	345,937	11,089	21,587	-	NA	NA	378,613
1986	350,227	3,276	13,158	-	NA	NA	366,661
1987	378,931	478	38,283	-	NA	NA	417,692
1988	408,668	15,438	35,820	-	NA	NA	459,926
1989	203,751	40,321	55,239	-	NA	NA	299,311
1990	297,858	29,578	69,723	-	NA	1,199	398,358
1991	203,035	60,797	85,983	-	NA	41,322	391,137
1992	340,146	9,486	46,968	18,518	NA	8,315	423,433
1993	277,033	28,694	65,604	23,312	NA	5,078	399,721
1994	150,039	2,369	52,526	10,313	NA	1,515	216,762
1995	81,454	458	21,675	13,956	NA	5,868	123,411
1996	4	58	2,266	10,229	NA	-	12,557
1997	52,688	5,934	47,355	6,400	NA	5,678	118,055
1998	5,140	345	55,697	4,177	NA	7,172	72,531
1999	7,434	112	47,163	31,106	NA	3,591	89,406
2000	64,547	126	4,468	38,038	NA	-	107,179
2001	79,668	11	6,423	40,179	6,198	-	132,479
2002	126,383	260	36,140	32,115	77	10,785	205,760
2003	146,736	9,251	51,622	23,995	NA	10,000	241,604
2004	171,166	12,348	61,132	42,496	26	16,696	303,864
2005	148,798	23,599	41,710	53,928	6,225	35,000	309,260
2006	109,004	20,308	41,380	37,905	NA	28,628	237,225
2007	94,921	26,881	38,611	46,229	NA	20,098	226,740
2008	95,170	8,257	24,855	50,556	NA	12,159	190,997
2009	58,191	9,765	31,921	66,426	NA	9,026	175,329
2010	84,123	1,747	24,687	54,924	NA	7,485	172,966
2011	129,023	21,843	52,131	75,209	NA	22,794	301,000

Troll: Areas 21, 23-27, and 121-127; net: Areas 21, and 23-27; sport: Areas 23a, 23b, 24-27

[1]Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2]Including 5,000 First Nations troll catch.

[3]Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

[4]Prior to 1992, catch was not reported as 'inside' or 'outside'. Therefore 'inside' catch for those years represents total tidal sport catch. [5]First Nations catch is mainly commercial catch 1996-2004 has been updated.

Appendix A.5Johnstone Strait Chinook salmon catches.

Year	Johnstone Strait					
	Troll[1,2]	Net[2]	Tidal Sport[3]	Freshwater Sport	First Nations	Total
1975	18,065	30,295	NA	NA	NA	48,360
1976	30,838	31,855	NA	NA	NA	62,693
1977	26,868	49,511	NA	NA	NA	76,379
1978	13,052	55,148	NA	NA	NA	68,200
1979	13,052	31,291	NA	NA	NA	44,343
1980	11,743	30,325	NA	NA	NA	42,068
1981	13,035	28,620	NA	NA	NA	41,655
1982	11,234	29,454	NA	NA	NA	40,688
1983	14,653	28,364	NA	NA	NA	43,017
1984	9,260	18,361	NA	NA	NA	27,621
1985	3,567	38,073	NA	NA	NA	41,640
1986	3,951	17,866	NA	NA	NA	21,817
1987	1,780	13,863	NA	NA	NA	15,643
1988	1,566	6,292	NA	NA	NA	7,858
1989	1,825	29,486	NA	NA	NA	31,311
1990	2,298	18,433	NA	NA	NA	20,731
1991	1,228	15,071	9,311	NA	1,287	27,661
1992	2,721	9,571	15,470	NA	29	27,036
1993	4,172	15,530	12,679	NA	20	19,722
1994	2,231	8,991	5,433	NA	0	11,222
1995	4	970	4,296	NA	71	1,045
1996	0	472	3,057	NA	107	579
1997	1,246	1,018	4,047	NA	179	2,443
1998	2,129	328	2,710	NA	138	4,961
1999	273	472	8,985	NA	469	9,027
2000	85	280	5,960	NA	212	6,296
2001	453	332	4,150	NA	370	4,914
2002	129	569	3,696	NA	400	3,429
2003	719	306	9,851	NA	130	8,740
2004	316	525	16,131	NA	28	13,706
2005	2	291	16,076	NA	NA	12,302
2006	0	244	10,532	NA	200	7,682
2007	0	2	9,882	NA	200	9,124
2008	0	48	4,436	NA	324	4,102
2009	0	597	11,501	NA	344	11,717
2010	2	98	10,016	NA	250	10,366
2011	0	46	11,934	NA	268	12,248

Troll: Area 12 net: Areas 11-13

Sport: Based on July – August creel census in Area 12 and northern half of Area 13

[1]Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2]Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization Project.

[3]Tidal sport creel catches include additional catch estimated using Argue et al, 1977.

Appendix A.6Strait of Georgia Chinook salmon catches.

Year	Georgia Strait				
	Troll[1,2]	Net[2,3]	Tidal Sport	First Nations	Total
1975	174,001		398,000		572,001
1976	200,229		490,000		690,229
1977	248,082		372,000		620,082
1978	217,955		500,000		717,955
1979	255,057		350,000		605,057
1980	273,077		204,100		477,177
1981	239,266		197,239		436,505
1982	179,040		124,390		303,430
1983	105,133		198,433		303,566
1984	90,280		369,445		459,725
1985	55,888		234,838		290,726
1986	44,043		181,896		225,939
1987	38,084		121,081		159,165
1988	20,224		119,117		139,341
1989	28,444		132,846		161,290
1990	34,304		111,914		146,218
1991	32,412		115,523		147,935
1992	37,250		116,581		153,831
1993	33,293		127,576		160,869
1994	12,916		70,839		83,755
1995	138		62,173		62,311
1996	14	8	89,589		89,611
1997	806	1	56,332		57,139
1998	303	11	20,923		21,237
1999	219	0	43,588		43,807
2000	609	0	32,750		33,359
2001	311	3	31,259		31,573
2002	459	16	52,979		53,454
2003	287	18	19,981		20,286
2004	462	0	13,475		13,937
2005	0	20	11,972		11,992
2006	0	0	12,181		12,181
2007	0	0	14,561		14,561
2008	0	0	8,836	4,848	13,684
2009	0	239	17,884		18,123
2010	5	54	14,942	40	15,041
2011	0	3	21,651	2,379	24,033

Troll: Areas 13-18; net: Areas 14-19; sport: Areas 13-18, 19a.

[1]Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2]Troll and net catches from 1996-2004 have been updated with data from the Catch Finalization project.

[3]Georgia Strait Chinook salmon net catch is by-catch from non-target fisheries.

Appendix A.7Fraser River Chinook salmon catches.

Year	Fraser River Watershed			
	Net[1]	Freshwater Sport[2,3]	First Nations[4]	Total
1975	66,119	7,740	20,170	94,029
1976	73,018	6,354	19,189	98,561
1977	85,222	3,071	23,310	111,603
1978	50,247	3,627	19,541	73,415
1979	51,488	4,450	10,217	66,155
1980	40,061	7	10,528	50,596
1981	22,447	0	8,389	30,836
1982	23,792	96	29,043	52,931
1983	25,580	0	11,875	37,455
1984	27,929	160	17,111	45,200
1985	28,894	596	8,387	37,877
1986	31,401	1,421	12,274	45,096
1987	12,021	3,561	12,050	27,632
1988	8,446	3,702	12,063	24,211
1989	23,443	2,500	4,784	30,727
1990	15,689	2,799	14,180	32,668
1991	14,757	3,116	13,950	31,823
1992	7,363	4,677	10,067	22,107
1993	13,885	3,430	15,395	32,710
1994	13,693	3,195	17,892	34,780
1995	6,451	8,258	17,791	32,500
1996	12,910	7,635	12,665	33,210
1997	40,877	5,051	13,453	59,381
1998	8,292	18,073	14,702	41,067
1999	4,043	8,509	17,999	30,551
2000	8,244	11,727	20,839	40,810
2001	10,398	23,047	18,429	51,874
2002	9,732	24,355	21,796	55,883
2003	11,204	18,014	28,137	57,355
2004	19,224	18,581	31,165	68,970
2005	9,088	22,688	19,832	51,608
2006	7,686	26,662	14,793	49,141
2007	6,795	12,945	13,714	33,454
2008	4,575	18,597	22,417	45,589
2009	7,848	17,485	27,288	52,621
2010	13,953	14,324	15,432	43,709
2011	17,989	18,951	33,118	70,058

[1]Fraser River net includes commercial Area E Gillnet, test fisheries, First Nations economic opportunities and scientific licenses.

[2]Freshwater sport catch includes Fraser mainstem and tributary Chinook salmon catch (adults only).

[3]Updated 1975-1980 sport catch from Fraser et al.1982.

[4]First Nations Chinook salmon catch includes food, social and ceremonial from the mainstem and tributaries. Economic opportunity included in commercial net.

Appendix A.8Canada – Strait of Juan de Fuca Chinook salmon catches.

Year	Canada – Strait of Juan de Fuca				
	Net[1]	Tidal Sport	Freshwater Sport[2]	First Nations	Total
1975	9,799	NA	NA	NA	9,799
1976	13,004	NA	NA	NA	13,004
1977	25,344	NA	NA	NA	25,344
1978	9,725	NA	NA	NA	9,725
1979	8,665	NA	NA	NA	8,665
1980	3,438	37,900	NA	NA	41,338
1981	9,982	29,832	NA	NA	39,814
1982	7,072	30,646	NA	NA	37,718
1983	328	30,228	NA	NA	30,556
1984	6,237	24,353	NA	NA	30,590
1985	17,164	27,843	NA	NA	45,007
1986	17,727	34,387	NA	NA	52,114
1987	6,782	24,878	NA	NA	31,660
1988	4,473	31,233	NA	NA	35,706
1989	21,238	32,539	NA	NA	53,777
1990	7,405	30,127	NA	42	37,574
1991	8,893	19,017	NA	250	28,160
1992	10,023	21,090	NA	302	31,415
1993	2,287	13,967	NA	317	16,571
1994	8,931	14,372	NA	600	23,903
1995	631	14,405	NA	751	15,787
1996	655	19,012	NA	20	19,687
1997	657	17,080	NA	42	17,779
1998	495	9,709	NA	1,500	11,704
1999	771	14,808	NA	52	15,631
2000	199	10,973	NA	272	11,444
2001	439	23,463	NA	135	24,037
2002	345	24,084	NA	NA	24,429
2003	292	26,630	NA	NA	26,922
2004	187	40,877	NA	NA	41,064
2005	153	30,480	NA	NA	30,633
2006	155	26,437	NA	NA	26,592
2007	138	26,549	NA	NA	26,687
2008	172	22,263	NA	NA	22,435
2009	385	25,587	NA	NA	25,972
2010	206	15,612	NA	NA	15,818
2011	278	21,075	NA	NA	21,353

Net: Area 20, Sport: Areas 19b and 20

NA=not available

[1]Net catches from 1996-2004 have been updated with data from the Catch Finalization project.

[2]While catch records are poor, in-river sport catch is believed to be small

Appendix A.9Washington – Strait of Juan de Fuca Chinook salmon catches.

Year	Washington – Strait of Juan de Fuca			
	Troll	Net	Sport	Total
1975	5,752	8,048	81,681	95,481
1976	10,488	6,072	75,308	91,868
1977	8,915	14,930	53,238	77,083
1978	10,006	11,224	62,299	83,529
1979	7,804	10,939	67,094	85,837
1980	10,682	11,320	56,415	78,417
1981	15,638	18,541	51,352	85,531
1982	19,024	22,547	29,842	71,413
1983	18,489	16,141	58,060	92,690
1984	15,650	12,120	48,003	75,773
1985	11,808	12,784	44,267	68,859
1986	30,000	17,000	69,000	116,000
1987	45,000	11,000	53,000	109,000
1988	49,000	10,000	39,000	98,000
1989	65,000	10,000	52,000	127,000
1990	47,162	5,294	50,903	103,359
1991	37,127	3,390	39,667	80,184
1992	31,452	927	38,438	70,817
1993	9,794	1,482	32,434	43,710
1994	3,346	5,864	1,661	10,871
1995	6,397	4,769	6,349	17,515
1996	9,757	604	4,825	15,186
1997	829	492	12,238	13,559
1998	338	265	2,159	2,762
1999	544	589	1,990	3,123
2000	332	640	1,670	2,642
2001	1,974	931	4,819	7,724
2002	1,783	1,076	2,028	4,887
2003	436	908	5,290	6,634
2004	20,627	592	4,519	25,738
2005	5,344	175	2,700	8,219
2006	1,115	957	5,695	7,767
2007	4,329	107	6,967	11,403
2008	1,816	4,579	4,844	11,239
2009	3,280	99	11,167	14,546
2010	2,011	1,339	11,508	14,858
2011	4,090	352	9,173[1]	13,615

Troll: Areas 5 and 6C; Area 4B from January 1 – April 30 and October 1 – December 31
Net: Areas 4B, 5, and 6C
Sport: Areas 5 and 6, 4B Neah Bay "add-on" fishery
[1] Current year not available; catches are average of previous three years.

Appendix A.10Washington – San Juan Chinook salmon catches.

Year	Washington – San Juan			
	Troll	Net	Sport	Total
1975	3	90,100	31,988	122,091
1976	0	66,832	34,505	101,337
1977	62	84,316	14,049	98,427
1978	3	87,565	15,083	102,651
1979	5	53,750	17,367	71,122
1980	0	64,338	12,231	76,569
1981	4	50,695	9,727	60,426
1982	0	38,763	6,953	45,716
1983	2	28,497	15,166	43,665
1984	83	33,432	25,759	59,274
1985	872	33,579	12,610	47,061
1986	0	21,000	15,000	36,000
1987	0	29,000	14,000	43,000
1988	0	32,000	9,000	41,000
1989	1,000	16,000	9,000	26,000
1990	666	8,608	7,370	16,644
1991	135	11,753	5,115	17,003
1992	172	14,011	6,788	20,971
1993	243	14,002	6,916	21,161
1994	73	13,908	5,795	19,776
1995	9	5,333	7,863	13,205
1996	153	3,934	12,674	16,761
1997	29	29,593	9,155	38,777
1998	376	3,804	3,069	7,249
1999	114	3	3,421	3,538
2000	22	1,091	4,447	5,560
2001	0	970	6,522	7,492
2002	0	2,231	4,827	7,058
2003	0	4,827	3,008	7,835
2004	123	5,184	1,971	7,228
2005	0	4,358	2,703	7,061
2006	0	5,278	4,168	9,446
2007	0	2,621	4,955	7,575
2008	0	48	5,829	5,877
2009	0	1,014	4,077	5.091
2010	0	5,950	3,157	9,107
2011	0	5,810	4,354[1]	10,164

Troll: Areas 6, 6A, 7, and 7A
Net: Areas 6, 6A, 7 and 7A
Sport: Area 7
[1] Current year not available; catches are average of previous three years.

Appendix A.11Washington – Other Puget Sound Chinook salmon catches.

Year	Washington – Other Puget Sound		
	Net	Sport	Total
1975	131,982	173,086	305,068
1976	141,281	151,246	292,527
1977	145,470	97,761	243,231
1978	150,298	116,979	267,277
1979	128,073	156,402	284,475
1980	171,516	142,799	314,315
1981	145,152	106,048	251,200
1982	149,274	85,703	234,977
1983	134,492	123,752	258,244
1984	180,248	102,740	282,988
1985	184,907	92,603	277,510
1986	153,000	88,000	241,000
1987	127,000	59,000	186,000
1988	133,000	63,000	196,000
1989	156,000	75,000	231,000
1990	179,593	71,000	250,593
1991	89,495	48,859	138,354
1992	63,460	51,656	115,116
1993	54,968	41,034	96,002
1994	63,577	44,181	107,758
1995	63,593	61,509	125,102
1996	61,658	58,538	120,196
1997	47,522	43,961	91,483
1998	50,915	30,016	80,931
1999	91,947	34,116	126,063
2000	79,494	29,328	108,822
2001	123,266	40,170	163,436
2002	108,566	35,031	143,597
2003	86,206	32,210	118,416
2004	69,211	22,650	91,861
2005	82,629	30,760	108,638
2006	109,557	40,082	149,639
2007	118,628	57,468	176,096
2008	101,322	36,969	138,291
2009	68,764	33,332	102,096
2010	72,576	32,817	105,393
2011	100,692	34,373[1]	135,065

Net: Areas 6B, 6D, 7B, 7C, and 7E; Areas 8-13 (including all sub-areas); Areas 74C – 83F
Sport: Areas 8-13 and all Puget Sound Rivers
[1] Current year not available; catches are average of previous three years.

Appendix A.12Washington – Inside Coastal Chinook salmon catches.

Year	Washington – Inside Coastal		
	Net	Sport	Total
1975	34,859	1,716	36,575
1976	51,995	2,219	54,214
1977	72,467	2,043	74,510
1978	32,662	3,399	36,061
1979	36,501	2,199	38,700
1980	47,681	1,476	49,157
1981	36,880	786	37,666
1982	33,271	1,114	34,385
1983	16,210	1,452	17,662
1984	16,239	1,319	17,558
1985	25,162	1,955	27,117
1986	29,000	3,000	32,000
1987	51,000	3,000	54,000
1988	74,000	7,000	81,000
1989	85,000	6,000	91,000
1990	57,770	5,000	62,770
1991	54,397	6,070	60,467
1992	64,223	6,577	70,800
1993	59,285	9,180	68,465
1994	46,059	7,454	53,513
1995	46,490	9,881	56,371
1996	55,408	12,059	67,467
1997	28,269	6,619	34,888
1998	20,266	6,569	26,835
1999	11,400	3,165	13,565
2000	15,660	3,179	18,839
2001	19,480	8,645	28,125
2002	23,372	6,038	29,410
2003	18,443	6,075	24,518
2004	21,965	12,088	34,053
2005	20,668	7,051	27,719
2006	27,414	8,030	35,444
2007	12,353	5,066	17,419
2008	15,028	3,808	19,034
2009	18,728	6,629	25,452
2010	12,794	6,831	12,794
2011	39,034	5,756[1]	44,790

Net: Areas 2A – 2M; Areas 72B – 73H

Sport: All coastal rivers, Area 2.1, and Area 2.2 (when Area 2 is closed)

[1] Current year not available; catches are average of previous three years.

Appendix A.13Washington/Oregon North of Cape Falcon Chinook salmon catches.

Year	Washington/Oregon North of Cape Falcon			
	Troll	Net	Sport	Total
1975	268,971	1,212	265,785	535,968
1976	371,239	203	215,319	586,761
1977	244,491	4	197,563	442,058
1978	150,673	4	104,306	254,983
1979	133,035	3	84,977	218,015
1980	125,709	1,215	59,099	186,023
1981	109,519	209	96,151	205,879
1982	154,720	267	114,952	269,939
1983	63,584	62	51,789	115,435
1984	15,392	0	6,980	22,372
1985	55,408	493	30,189	86,090
1986	52,000	0	23,000	75,000
1987	81,000	4,000	44,000	129,000
1988	108,000	3,000	19,000	130,000
1989	74,600	1,000	20,900	96,500
1990	65,800	0	32,900	98,700
1991	51,600	0	13,300	64,900
1992	69,000	0	18,900	87,900
1993	55,900	0	13,600	69,500
1994	4,500	0	0	4,500
1995	9,500	0	600	10,100
1996	12,300	0	200	12,500
1997	20,500	0	4,100	24,600
1998	20,615	0	2,292	22,907
1999	44,923	0	10,821	55,744
2000	20,152	0	9,242	29,394
2001	54,163	0	25,592	79,755
2002	106,462	0	60,575	167,037
2003	101,758	0	36,513	138,271
2004	88,225	0	27,090	115,315
2005	87,126	0	40,004	127,130
2006	57,313	0	11,176	68,489
2007	38,742	0	9,535	48,277
2008	35,100	0	15,452	50,552
2009	25,410	0	13,331	38,741
2010	88,565	0	38,686	127,151
2011	61,423	0	30,826	92,249

Troll: Oregon Area 2; Washington Areas 1, 2, 3 and 4: Area 4B from May 1 through September 30 (during Pacific Fishery Management Council management)
Net: Washington Areas 1, 2, 3, 4, 4A
Sport: Oregon Area 2; Washington Areas 1, 1.1, 1.2, 2, 3, 4 and 2.2 (when Area 2 is open)

Appendix A.14Columbia River Chinook salmon catches.

Year	Columbia River[1]			
	Non-treaty net	Treaty Indian	Sport	Total
1975	323,000	NA	34,870	357,870
1976	288,400	NA	42,527	330,927
1977	255,600	NA	58,838	314,438
1978	189,100	NA	56,582	245,682
1979	169,691	7,865	38,700	216,256
1980	113,569	35,604	15,011	164,184
1981	35,881	54,190	21,151	111,222
1982	94,289	70,778	31,236	196,303
1983	32,877	37,128	23,206	93,211
1984	73,481	63,260	43,760	180,501
1985	74,982	83,236	45,444	203,662
1986	168,038	122,180	57,993	348,211
1987	340,931	157,857	105,790	604,579
1988	341,114	170,441	97,538	609,093
1989	146,739	152,047	88,088	386,874
1990	63,602	102,597	79,445	245,644
1991	53,935	65,083	79,257	198,275
1992	24,063	48,704	56,317	129,084
1993	19,929	73,912	64,693	158,533
1994	2,773	37,617	29,626	70,016
1995	777	43,422	36,392	80,591
1996	17,774	78,788	31,660	128,222
1997	11,268	82,281	45,253	138,802
1998	6,464	50,072	34,218	90,754
1999	10,115	82,788	45,019	137,922
2000	22,015	86,586	48,219	156,820
2001	45,416	218,953	132,611	396,980
2002	73,658	211,825	140,590	426,073
2003	79,202	173,579	139,802	392,583
2004	80,434	175,556	144,149	400,139
2005	46,907	142,805	88,203	277,915
2006	46,163	122,548	70,419	239,130
2007	28,031	68,739	53,827	150,597
2008	54,008	153,617	83,530	291,155
2009	56,036	133,444	85,074	274,554
2010	93,730	237,090	155,745	486,564
2011	99,075	193,255	132,109	424,439

[1]The historical time series of catches in this year's report has changed from previous year's report. Catches after 1980 have been broken out into non-treaty net and treaty Indian due to the inability to separate Treaty Indian commercial versus non-commercial. Non-treaty net includes catches by Wanapum and Colville tribes. Sport and total catches from 1975-1980 are consistent with previous year's reports.

Appendix A.15Oregon Chinook salmon catches.

Year	Oregon		
	Troll	Sport	Total
1975	300	19,000	19,300
1976	1,000	21,000	22,000
1977	3,000	34,000	37,000
1978	1,000	37,000	38,000
1979	800	31,000	31,800
1980	300	22,000	22,300
1981	300	28,000	28,300
1982	500	23,000	23,500
1983	700	19,000	19,700
1984	1,088	27,000	28,088
1985	1,700	25,000	26,700
1986	1,900	33,000	34,900
1987	3,600	46,000	49,600
1988	4,800	49,000	53,800
1989	4,500	45,000	49,500
1990	0	38,000	38,000
1991	0	44,500	44,500
1992	384	39,000	39,384
1993	649	52,000	52,649
1994	371	33,590	33,961
1995	206	48,366	48,572
1996	989	56,202	57,191
1997	513	37,659	38,172
1998	858	37,990	38,848
1999	1,233	30,735	31,968
2000	1,860	33,262	35,122
2001	1,184	54,988	56,172
2002	1,633	61,085	62,718
2003	1,459	67,939	69,398
2004	2,258	71,726	73,984
2005	1,956	27,866	29,822
2006	1,884	39,357	41,241
2007	1,018	25,684	26,702
2008	208	10,780	10,988
2009	293	6,537	6,830
2010	1,315	22,362	23,677
2011	1,954	27,353	29,307

Troll: late season off Elk River mouth
Sport: estuary and inland
NA = not available

Appendix B. Escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks, 1975-2010.

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Appendix B.1. Southeast Alaska and Transboundary river escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Southeast Alaska Stocks					
	Situk River		Chilkat	King	Andrew	Unuk
Year	esc.	term. run	River esc.	Salmon River esc.	Creek esc.	River esc.
1975				64	507	
1976	1,421	3,184		99	404	
1977	1,732	2,981		204	456	4,706
1978	808	1,745		87	388	5,344
1979	1,284	3,089		134	327	2,783
1980	905	2,504		106	282	4,909
1981	702	1,857		154	536	3,532
1982	434	949		394	672	6,528
1983	592	1,290		245	366	5,436
1984	1,726	2,948		265	389	8,876
1985	1,521	2,916		175	622	5,721
1986	2,067	2,873		255	1,379	10,273
1987	1,379	2,874		196	1,537	9,533
1988	868	1,596		208	1,100	8,437
1989	637	1,377		240	1,034	5,552
1990	628	1,643		179	1,295	2,856
1991	889	2,095	5,897	134	780	3,165
1992	1,595	3,819	5,284	99	1,517	4,223
1993	952	2,558	4,472	266	2,067	5,160
1994	1,271	6,085	6,795	213	1,115	3,435
1995	4,330	14,987	3,790	147	669	3,730
1996	1,800	8,100	4,920	292	653	5,639
1997	1,878	6,601	8,100	362	571	2,970
1998	924	5,420	3,675	134	950	4,132
1999	1,461	7,208	2,271	304	1,180	3,914
2000	1,785	4,941	2,035	138	1,346	5,872
2001	656	2,317	4,517	149	2,055	10,541
2002	1,000	3,017	4,051	155	1,708	6,988
2003	2,117	6,280	5,657	119	1,160	5,546
2004	698	3,218	3,422	135	2,991	3,963
2005	595	1,153	3,366	143	1,979	4,742
2006	295		3,039	150	2,124	5,645
2007	677		1,442	181	1,736	5,668
2008	413		2,905	120	981	3,104
2009	902		4,429	109	628	3,157
2010	167		1,815	158	1,205	4,854
2011	240		2,803	192	936	3,272
Goal Lower	500		1,750	120	650	1,800
Goal Upper	1,000		3,500	240	1,500	3,800

(continued)

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Year	Southeast Alaska Stocks (cont.)			Transboundary River Stocks		
	Chickamin R. index esc.	Blossom R. index esc	Keta River	Alsek R. esc.	Taku R. esc.	Stikine R. esc.
1975	370	146	203		12,920	7,571
1976	157	68	84	5,282	24,582	5,723
1977	363	112	230	12,706	29,496	11,445
1978	308	143	392	12,034	17,124	6,835
1979	239	54	426	17,354	21,617	12,610
1980	445	89	192	10,862	39,239	30,573
1981	384	159	329	8,502	49,559	36,057
1982	571	345	754	9,475	23,847	40,488
1983	599	589	822	10,344	9,795	6,424
1984	1,102	508	610	7,238	20,778	13,995
1985	956	709	624	6,127	35,916	16,037
1986	1,745	1,278	690	11,069	38,110	14,889
1987	975	1,349	768	11,141	28,935	24,632
1988	786	384	575	8,717	44,524	37,554
1989	934	344	1,155	10,119	40,329	24,282
1990	564	257	606	8,609	52,143	22,619
1991	487	239	272	11,625	51,645	23,206
1992	346	150	217	5,773	55,889	34,129
1993	389	303	362	13,855	66,125	58,962
1994	388	161	306	15,863	48,368	33,094
1995	356	217	175	24,772	33,805	16,784
1996	422	220	297	15,922	79,019	28,949
1997	272	132	246	12,494	114,938	26,996
1998	391	91	180	6,833	31,039	25,968
1999	492	212	276	14,597	16,786	19,947
2000	801	231	300	7,905	34,997	27,531
2001	1,010	204	343	6,705	46,554	63,523
2002	1,013	224	411	5,569	55,044	50,875
2003	964	203	322	5,904	36,435	46,824
2004	798	333	376	7,083	75,032	48,900
2005	924	445	497	4,478	38,725	40,501
2006	1,330	339	747	2,323	42,296	24,405
2007	893	135	311	2,827	14,854	14,560
2008	1,111	257	363	1,885	27,383	18,352
2009	611	123	172	6,239	22,801	11,086
2010	1,156	180	475	9,518	29,302	15,180
2011	853	147	223	6,668	27,523	14,569
Goal Lower	450	150	175	3,500	19,000	14,000
Goal Upper	900	300	400	5,300	36,000	28,000

Appendix B.2. Northern British Columbia escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Northern British Columbia								
	Area 1 Yakoun R. esc.	Area 3[1] Nass R. Above GW[1]	Area 3[1] Nass R. esc.	Area 3[1] Nass R. tot. run	Area 4 Skeena R. esc.	Area 4 Skeena R. tot. run	Area 8 Dean R. index	Area 9 Rivers Inlet	Area 10 Smith Inlet[2]
1975	1,500		14,895	17,874	20,319			3,280	960
1976	700		13,819	16,583	13,078			1,640	1,000
1977	800	13,688	14,288	18,410	29,018	39,606		2,225	1,050
1978	600	15,485	16,885	21,807	22,661	35,055	3,500	2,800	2,100
1979	400	11,253	12,783	16,229	18,488	28,166	4,000	2,150	500
1980	600	13,476	14,855	18,744	23,429	38,626	2,000	2,325	1,200
1981	750	12,625	13,925	17,606	24,523	42,018	3,500	3,175	1,020
1982	1,400	7,959	10,359	13,287	17,092	35,185		2,250	1,500
1983	600	13,252	16,301	20,516	23,562	39,510	500	3,320	1,050
1984	300	20,967	24,967	31,408	37,598	53,516	4,500	1,400	770
1985	1,500	17,782	19,694	24,768	53,599	76,544	4,000	3,371	230
1986	500	36,523	38,123	47,967	59,968	87,566	3,300	7,623	532
1987	2,000	19,540	20,986	26,568	59,120	76,349	1,144	5,239	1,050
1988	2,000	15,345	16,715	21,094	68,705	102,563	1,300	4,429	1,050
1989	2,800	28,133	29,175	36,594	57,202	83,439	2,300	3,265	225
1990	2,000	24,051	26,551	33,384	55,976	89,447	2,000	4,039	510
1991	1,900	6,907	8,259	13,136	52,753	79,343	2,400	6,635	500
1992	2,000	16,808	17,408	25,405	63,392	92,184	3,000	7,500	500
1993	1,000	24,814	26,508	36,678	66,977	96,018	700	10,000	500
1994	2,000	21,169	25,689	32,864	48,712	68,127	1,300	3,500	700
1995	1,500	7,844	8,776	16,187	34,390	48,351	1,100	3,196	400
1996	3,000	21,842	22,712	30,889	73,684	96,453	2,000	3,000	250
1997	2,500	18,702	20,584	27,658	42,539	65,350	1,400	4,980	100
1998	3,000	23,213	25,361	34,922	46,744	65,167	3,000	5,367	1,100
1999	3,200	11,544	13,118	22,310	43,775	70,993	1,800	2,739	500
2000	3,600	18,912	20,565	31,159	51,804	77,320	1,200	6,700	500
2001	3,500	29,687	31,915	44,595	81,504	112,346	3,795	5,062	300
2002	3,000	13,773	15,382	21,528	44,771	63,069	3,731	5,031	
2003	4,000	26,940	28,330	36,503	56,758	82,410	3,700	1,900	
2004	4,500	15,912	18,185	25,137	44,243	61,065	3,500	3,950	
2005	5,000	14,363	16,595	24,067	29,067	39,278	2,200	5,585	
2006	NA	24,725	27,743	37,098	33,094	43,689	3,700	3,930	
2007	NA	21,459	25,524	34,221	33,352	44,185	2,300	5,000	
2008	NA	17,862	20,198	26,202	32,963	54,279	1,100	5,792	
2009	NA	28,710	30,334	36,865	38,297	55,921	1,400	4,580	
2010	NA	19,341	20,821	26,052	43,331	54,252	1,600	4,225	
2011	NA	9 639	10,415	15,092	37,073	46,683	750	4,400	

[1]GW refers to Gitwinksihlkw, the location of the lower fish wheels on the Nass River used to capture Chinook salmon for the mark-recapture estimate
[2]The Docee River was dropped as an escapement indicator beginning in 2002 due to an inability to obtain reliable escapement estimates

Appendix B.3. Southern British Columbia escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Southern British Columbia				
	WCVI	LGS			UGS
Year	esc.	Nanaimo	Cowichan	tot. run	Esc.[1]
1975	800	5,475		6,390	
1976	1,075	4,340		5,390	
1977	1,835	6,530		7,590	23,570
1978	2,750	6,495		7,035	17,572
1979	2,048	2,741	7,945	11,209	8,858
1980	5,974	2,982	5,837	10,519	5,776
1981	5,050	225	5,782	7,607	9,611
1982	6,812	1,152	5,034	6,657	15,091
1983	2,700	1,840	4,742	6,862	12,977
1984	3,862	3,178	5,278	8,861	9,292
1985	3,700	914	3,675	5,242	13,348
1986	2,760	958	2,147	3,776	24,804
1987	2,570	757	2,519	3,781	33,135
1988	4,560	1,079	6,878	8,638	9,142
1989	6,220	1,552	5,535	8,142	46,340
1990	3,660	1,397	5,626	7,627	13,694
1991	5,060	935	7,408	8,613	25,452
1992	4,830	1,127	10,250	11,637	17,742
1993	4,530	1,405	7,030	8,730	4,209
1994	4,080	1,072	6,407	7,824	3,992
1995	3,720	2,300	16,449	19,282	5,729
1996	6,020	1,870	14,595	17,275	4,567
1997	7,190	1,772	9,973	11,936	4,764
1998	11,650	1,800	5,858	8,731	11,136
1999	10,190	2,371	6,110	8,714	12,215
2000	4,580	1,446	6,638	8,223	17,841
2001	2,740	2,448	5,015	8,569	10,492
2002	4,290	1,747	4,115	7,812	13,506
2003	4,460	1,672	3,356	5,903	14,057
2004	8,460	550	2,721	3,641	8,247
2005	3,980	1,036	2,467	4,870	4,799
2006	4,580	2,135	1,775	4,880	15,611
2007	3,820	2,267	2,175	4,778	6,642
2008	4,320	2,671	2,015	5,646	5,663
2009	6,990	1,470	785	3,106	11,447
2010	7,630	2,201	2,879	6,176	7,954
2011	6,810	3,937	3,492	7,872	5,617
Goal			6,500		

[1]Upper Georgia Strait(UGS) escapement updated with time series for 5 stream index.
Refer to List of Acronyms for definitions.

Appendix B.4. Fraser River escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Fraser River						
Year	Fraser Spring Age 1.2 esc.	Fraser Spring Age 1.3 esc.	Fraser Summer Age 0.3 esc.	Fraser Summer Age 1.3 esc.	Fraser Spr/sum tot. run	Harrison esc.	Harrison tot. run
1975	7,179	8,184	26,875	16,875	119,081		
1976	4,600	10,307	4,925	13,630	98,691		
1977	3,675	13,261	19,600	17,240	132,553		
1978	4,305	15,725	16,700	19,200	109,119		
1979	2,770	14,985	18,275	10,205	101,252		
1980	6,255	16,521	8,350	13,625	71,504		
1981	2,975	12,274	13,120	12,202	62,668		
1982	5,510	15,010	6,850	15,088	85,140		
1983	2,641	24,225	9,500	16,604	72,526		
1984	6,380	30,370	15,522	13,595	95,681	120,837	131,740
1985	9,477	43,168	20,375	19,099	121,941	174,778	181,367
1986	10,275	48,446	22,460	32,505	144,617	162,596	177,662
1987	5,049	48,271	22,404	27,646	128,699	79,038	81,799
1988	4,003	41,783	29,567	32,066	129,587	35,116	38,285
1989	6,126	31,994	24,200	16,200	106,843	74,685	76,294
1990	3,225	41,560	25,425	33,747	135,124	177,375	180,837
1991	3,495	27,296	26,250	28,097	116,555	90,638	93,363
1992	5,937	33,038	32,200	38,011	130,249	130,411	132,042
1993	7,870	32,796	13,300	21,385	110,237	118,998	120,600
1994	10,696	51,655	25,350	23,657	145,303	98,334	100,839
1995	9,670	45,237	20,550	26,371	134,478	28,616	29,840
1996	20,726	38,398	50,900	43,142	185,559	37,394	38,568
1997	9,878	44,373	49,250	40,882	202,795	70,514	72,061
1998	3,003	37,862	68,033	36,750	169,333	188,425	189,103
1999	8,751	20,740	53,204	25,138	140,939	107,016	107,884
2000	11,731	26,773	45,161	25,869	155,209	77,035	78,098
2001	10,607	31,512	74,132	33,980	177,008	73,134	74,419
2002	16,423	42,408	85,132	34,886	221,020	89,968	91,122
2003	17,137	45,441	70,164	44,451	231,689	247,121	251,453
2004	12,156	31,614	53,764	30,980	194,440	128,990	138,890
2005	3,898	21,458	88,329	18,586	172,281	86,730	92,993
2006	6,642	21,699	149,928	20,565	242,878	50,942	52,798
2007	1,407	11,737	85,722	10,536	137,206	79,176	83,445
2008	6,121	17,181	106,539	15,431	187,591	41,603	43,798
2009	911	24,150	86,443	20,619	172,858	70,141	75,550
2010	6,576	18,029	156,657	18,229	199,491	103,515	106,777
2011	2,235	12,104	127,957	18,528	213,879	123,647	171,380
Goal Lower						75,100	
Goal Upper						98,500	

Appendix B.5. Puget Sound escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Puget Sound (includes hatchery strays in natural escapement)																
	Skagit Spring		Skagit Sum/fall		Stillaguamish			Snohomish		Green			Nooksack Spring esc.		Lake Washington Fall	
	esc.	tot. run	esc.	tot. run[1]	MR esc[2]	esc.	tot. run[1]	esc.	tot. run	MR esc[2]	esc.	tot. run	N. Fork	S. Fork	esc.	tot. run
1975	627	627	11,320	30,299		1,198	1,801	4,485	6,627		3,394	6,838			656	1004
1976	633	633	14,120	28,589		2,140	4,241	5,315	10,544		3,140	8,246			719	937
1977	520	520	9,218	21,502		1,475	2,847	5,565	10,676		3,804	5,936			675	889
1978	932	932	13,075	24,285		1,232	2,159	7,931	13,672		3,304	4,766			890	1353
1979	818	818	13,306	24,350		1,042	2,531	5,903	13,743		9,704	11,689			1,289	1578
1980	1,408	1,408	20,058	31,250		821	2,818	6460	17,653		7,743	11,248			1,360	1683
1981	1,045	1,045	8,283	21,817		630	3,014	3368	9,991		3,606	5,532			721	924
1982	753	753	9,910	24,259		773	3,229	4379	9,429		1,840	4,271			885	1384
1983	554	554	8,723	15,758		387	1,089	4549	11,236		3,679	14,376			1,332	2515
1984	696	696	12,628	15,616		374	920	3762	8,975		3,353	5,890	45	188	1,252	4211
1985	2,634	2,634	16,002	26,230		1,409	2,717	4,873	9,637		2,908	7,914	258	445	949	2627
1986	1,922	1,922	17,908	22,906		1,277	2,499	4,534	8,969		4,792	6,114	226	170	1,470	2863
1987	1,745	1,745	9,409	13,387		1,321	1,982	4,689	7,107		10,338	12,283	181	248	2,038	4835
1988	1,743	1,743	11,468	15,262		717	1,245	4,513	7,933		7,994	9,667	456	233	792	2829
1989	1,400	1,809	6,684	13,270		784	1,664	3,138	6,379		11,512	15,244	303	606	1,011	1544
1990	1,511	1,546	16,521	18,950		842	1,867	4,209	8,562		7,035	15,483	10	142	787	1098
1991	1,236	1,273	5,824	8,604		1,536	2,969	2,783	5,151		10,548	15,451	108	365	661	1115
1992	986	1,010	7,348	9,021		639	1,279	2,708	4,448		5,267	10,165	498	103	790	1212
1993	782	812	5,801	7,097		719	1,259	3,866	5,609		2,476	5,507	449	235	245	324
1994	470	496	5,549	5,912		773	1,323	3,626	5,039		4,078	8,368	45	118	888	926
1995	855	887	6,877	9,239		770	1,490	3,176	3,370		7,939	9,935	230	290	930	966
1996	1,051	1,078	10,613	10,828		1,244	2,276	4,851	4,877		6,026	8,664	534	203	336	362
1997	1,041	1,064	4,872	6,092		1,078	1,720	4,292	4,382		7,101	7,778	520	180	294	302
1998	1,086	1,091	14,609	14,965		1,540	2,430	6,304	6,376		5,963	7,777	368	157	697	711
1999	471	476	4,924	5,229		1,194	2,360	4,799	4,839		7,135	8,376	823	166	778	791
2000	1,021	1,025	16,930	17,265		1,612	3,032	6,092	6,120	10,526	4,473	6,880	1,245	284	347	393
2001	1,856	1,866	13,793	14,046		1,351	2,053	8,164	8,464	21,402	6,473	9,721	2,209	267	1,269	1555
2002	1,076	1,092	19,591	19,911		1,564	2,195	7,220	7,266	14,857	7,564	11,539	3,741	289	637	663
2003	909	987	9,777	10,106		990	1,322	5,447	5,597		5,864	7,871	2,857	204	771	826
2004	1,622	1,622	23,553	24,107		1,509	1,977	10,606	10,701		7,947	13,498	1,746	130	730	794
2005	1,305	1,305	20,803	23,405		1,036	1,493	4,484	4,680		2,523	2,987	2,167	120	726	788
2006	1,896	1,919	20,768	22,539		1,253	1,542	8,308	8,481		5,790	8,604	1,184	355	1,219	1433
2007	613	613	11,281	13,027	1,881	607	866	3,982	4,004		4,301	7,205	1,438	182	1,968	3342
2008	1,472	1,472	11,664	14,995	1,836	1,671	1,861	8,373	8,494		5,971	10,290	1,266	318	941	2917
2009	983	983	6,955	12,460	1,110	1,001	1,218	2,161	2,347		688	1,067	1,903	294	793	951
2010	1,361	1,537	8,037	9,060	1,381	783	1,014	4,299	4,697	4,541	2,092	2,112	2,044	377	729	734
2011	825	1,015	5,536	9,181		1,018	1,413	1,880	1,892		993	1,464	875	124	906	1,034

[1]Escapement excludes brood stock collected for supplementation program Total run includes redd count based escapement of all natural spawners, terminal catch, and adult brood stock collected for supplementation and PSC indicator program

[2] Escapement estimated from mark-recapture studies funded under Sentinel Stocks Program and/or U S LOA

Appendix B.6. Washington Coast escapements and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Washington Coast																		
Year	Quillayute Summer		Quillayute Fall		Hoh Spr/Sum		Hoh Fall		Hoko Fall		Queets Spr/Sum		Queets Fall		Grays Harbor Spring		Grays Harbor Fall	
	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.[1]	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run
1976	1,300	1,700			600	1,300	2,500	3,100			505	737	1,200	2,500	600	1,000	1,836	10,313
1977	3,800	5,300			1,000	2,000	2,100	3,800			732	1,155	3,600	5,500	800	1,700	5,195	14,400
1978	2,300	2,700			1,400	2,472	1,900	2,900			1,110	1,406	2,200	3,100	1,000	1,600	4,555	8,372
1979	2,100	3,900			1,400	2,326	1,700	2,200			870	1,369	3,900	4,700	400	1,100	9,381	10,101
1980	964	1,500	6,700	7,600	800	1,079	2,200	2,800			1,038	1,213	3,200	5,800	200	600	11,656	21,639
1981	815	1,700	5,963	7,102	1,498	2,005	3,100	4,000			988	1,329	4,250	8,200	600	900	7,577	11,915
1982	1,126	2,700	7,107	9,651	1,553	2,125	4,500	5,800			781	1,244	4,150	6,600	610	669	5,606	13,296
1983	548	1,800	3,069	5,530	1,696	2,233	2,500	3,300			1,044	1,173	2,750	4,400	800	850	5,482	8,997
1984	618	1,000	9,128	10,447	1,430	2,005	1,900	2,600			958	1,189	4,350	6,300	1,128	1,130	21,058	22,616
1985	550	700	6,145	8,367	978	1,353	1,725	2,720			677	886	4,150	5,910	1,157	1,159	9,537	15,153
1986	853	1,000	10,006	13,380	1,248	1,912	4,981	6,000	801	801	925	1,193	7,894	9,180	1,795	1,826	13,951	21,534
1987	666	1,600	12,352	20,349	1,710	2,480	4,006	6,147	581	581	598	1,543	6,557	10,638	841	1,071	19,023	30,861
1988	2,599	3,943	15,168	22,115	2,605	3,708	4,128	6,873	686	776	1,765	2,267	9,494	12,505	3,106	3,208	27,216	36,778
1989	2,407	3,472	9,951	17,260	4,697	6,820	5,148	8,682	775	842	2,568	3,954	9,324	12,213	2,068	2,393	25,599	52,777
1990	1,483	1,840	13,711	16,914	3,886	5,294	4,236	6,327	378	493	1,780	2,480	10,569	13,155	1,567	1,630	16,580	36,821
1991	1,188	1,500	6,292	7,631	1,078	1,693	1,420	2,628	894	1,006	630	761	4,795	6,593	1,289	1,489	13,432	29,158
1992	1,009	1,271	6,342	7,750	1,018	1,443	4,003	5,139	642	740	375	505	4,911	6,880	1,813	1,851	13,175	24,162
1993	1,292	1,531	5,254	5,735	1,411	2,065	2,280	3,951	775	894	713	788	3,463	5,667	1,254	1,399	11,844	24,487
1994	974	1,187	4,932	5,692	1,699	2,372	3,967	4,322	332	428	705	727	4,233	6,854	1,403	1,479	11,817	24,015
1995	1,333	1,731	5,532	6,716	1,132	1,686	2,202	2,912	750	905	625	662	3,127	5,101	2,070	2,167	9,952	23,570
1996	1,170	1,388	7,316	9,293	1,371	2,083	3,022	4,061	1,227	1,265	776	891	4,218	5,927	4,462	4,655	16,988	26,618
1997	890	1,177	5,405	6,047	1,826	2,582	1,773	3,034	768	894	540	693	2,872	4,945	4,460	4,812	16,342	26,948
1998	1,599	1,829	6,752	7,940	1,287	1,880	4,257	5,388	1,618	1,722	492	537	3,859	5,173	2,388	2,679	11,476	17,368
1999	713	818	3,334	4,758	928	1,081	1,924	2,941	1,497	1,688	373	426	1,918	3,105	1,285	1,555	9,196	10,859
2000	989	1,149	3,730	4,794	492	529	1,749	2,632	612	731	248	250	3,755	4,147	3,135	3,424	8,081	13,010
2001	1,255	1,429	5,136	7,545	1,159	1,231	2,560	4,116	768	946	548	565	3,099	4,808	2,860	3,326	8,340	17,109
2002	1,002	1,100	6,067	9,492	2,464	3,375	4,415	5,716	443	680	738	755	2,589	5,561	2,598	3,217	10,621	13,942
2003	1,219	1,262	7,398	9,469	1,228	1,646	1,649	2,345	863	1,098	189	195	4,979	6,618	1,904	2,101	17,808	19,488
2004	1,093	1,189	3,831	6,133	1,786	2,239	3,237	4,410	866	1,086	604	619	5,105	6,797	5,034	5,330	29,461	38,161
2005	876	965	6,406	8,319	1,193	1,389	4,180	5,337	203	284	298	306	4,557	6,734	2,130	2,683	17,040	19,599
2006	553	604	5,642	7,646	904	1,061	1,535	2,324	845	895	330	336	3,051	4,258	2,481	2,863	15,955	20,482
2007	502	568	3,066	4,137	810	1,023	1,556	2,427	462	568	352	358	878	1,600	652	999	11,264	15,126
2008	949	1,134	3,612	5,250	671	717	2,849	3,761	431	483	305	305	2,790	4,157	996	1,282	13,570	15,666
2009	464	682	3,130	5,874	880	913	2,081	2,851	103	385	495	495	4,156	5,939	1,133	1,358	7,215	10,832
2010	659	828	4,635	6,431	828	861	2,599	2,941	319	793	382	382	4,022	6,032	3,497	3,704	14,531	18,802
2011	600	995	3,993	7,207	827	948	1,293	2,157	1,275	1,504	373	373	3,928	6,479	2,563	2,664	18,311	26,553
Goal			3,000		900		1,200				700		2,500					

[1] Escapement excludes brood stock for supplementation program Total run includes redd count based escapement, terminal catch, and adult brood stock collected for supplementation and PSC indicator program

Appendix B.7. Columbia River escapements and terminal runs of Pacific Salmon Commission CTC wild Chinook salmon escapement indicator stocks.

Year	Columbia Upriver Spring		Snake River Spring/Summer		Columbia Upriver Summers /1		Lewis River /2 Fall Chinook		Columbia Upriver Fall Chinook				
									Deschutes River /3			Brights /4	
	esc.	t.run	esc.	t.run	esc.	t.run	esc.	t.run	esc.	esc.	t.run	esc.	t.run
1975							13,859	13,859	Mark	Above Falls		29,600	163,833
1976							3,371	3,371	Recapture	Expanded		27,700	109,076
1977							6,930	6,930		7,903	9,764	36,060	85,336
1978							5,363	5,363		5,393	7,364	25,798	77,936
1979	31,381	32,636			18,797	22,142	8,023	8,023		5,126	6,718	28,926	82,482
1980	32,983	34,090	6,134	20,968	13,854	22,498	16,394	16,856		4,106	6,057	27,708	70,743
1981	35,069	36,959	11,318	25,163	8,639	18,746	19,297	20,298		6,070	7,907	19,520	58,693
1982	39,930	42,933	11,307	28,317	6,587	14,369	8,370	10,126		5,513	7,529	28,313	71,471
1983	31,946	33,355	9,845	21,290	6,334	13,145	13,540	14,489		5,491	6,987	45,567	79,113
1984	25,339	27,210	7,929	14,437	13,984	18,765	7,132	8,128		2,779	3,749	52,266	127,651
1985	32,263	33,450	10,682	15,081	14,505	18,522	7,491	8,241		7,902	8,709	74,206	187,691
1986	40,764	43,329	11,359	20,404	14,850	18,752	11,983	13,504		7,467	8,620	93,051	272,949
1987	35,312	37,620	10,140	16,390	13,415	22,715	12,935	14,173		9,187	11,244	126,153	409,412
1988	32,629	35,108	11,182	17,776	13,634	22,720	12,059	13,636		9,548	11,939	98,220	327,976
1989	32,517	35,230	6,499	15,113	17,484	22,201	21,199	22,813		6,339	8,069	83,281	253,233
1990	31,067	33,371	9,357	17,928	13,432	18,794	17,506	18,784		2,864	3,834	49,020	149,759
1991	20,557	21,930	5,756	13,357	10,191	14,323	9,066	10,354		5,374	5,528	40,132	97,758
1992	34,030	36,248	12,677	21,209	7,706	9,428	6,307	7,129		3,668	3,705	41,434	77,311
1993	30,213	32,187	12,531	18,427	12,927	14,021	7,025	8,106		8,809	8,820	42,515	94,088
1994	9,289	9,780	1,856	4,042	12,292	14,691	9,939	10,541		9,556	9,625	66,645	123,214
1995	4,812	5,062	1,167	3,418	10,623	12,455	9,718	12,155		9,304	9,340	50,595	97,119
1996	19,484	20,562	3,643	9,023	9,417	12,080	13,971	13,971		10,233	10,311	53,049	132,882
1997	17,996	19,288	5,042	9,584	10,063	17,709	8,670	8,670		20,208	20,341	50,215	141,386
1998	17,789	18,730	7,291	13,729	11,225	15,536	5,929	5,929		15,908	16,415	42,113	125,886
1999	11,170	11,710	2,853	5,802	18,588	21,867	3,184	3,184		7,389	7,762	43,313	158,044
2000	51,918	55,287	8,187	13,919	20,218	22,595	9,820	9,820		4,985	5,392	60,988	150,352
2001	96,138	110,753	44,572	63,482	48,844	52,960	13,886	14,186	9,527	12,817	9,861	84,652	222,630
2002	50,950	57,143	29,872	52,877	86,825	89,524	16,380	18,230	11,133	11,907	12,125	116,858	265,144
2003	53,316	57,934	32,080	51,392	81,543	83,058	18,505	20,505	14,265	13,413	15,343	161,136	357,848
2004	57,002	62,514	20,967	33,713	62,311	65,623	15,342	17,133	10,197	10,197	11,421	149,529	356,437
2005	31,724	33,868	9,832	15,317	54,033	60,272	11,348	13,348	9,355	14,937	10,190	111,721	258,554
2006	27,832	29,818	9,340	16,824	61,821	77,573	10,522	11,999	14,196	14,223	14,981	76,722	215,407
2007	14,368	15,443	6,903	10,700	28,222	37,035	3,468	3,606	13,181	12,721	13,968	45,652	98,657
2008	25,077	29,003	17,171	24,014	38,171	55,532	5,200	5,200		6,908	7,614	74,386	189,681
2009	30,054	32,496	14,313	21,183	44,295	53,881	5,410	5,760		6,429	7,116	85,759	204,932
2010	50,231	58,160	25,211	35,613	47,220	72,346	8,701	8,701		9,275	10,066	167,007	314,842
2011	39,014	41,702	23,844	31,600	44,432	80,574	8,009	11,025		17,117	18,168	130,395	305,940
Goal					12,143		5,700			4,532		40,000	

[1] Based on a S-R analysis of model data which included both hatchery and wild fish, an interim goal of 12,143 adult Mid-Columbia Summers at Rock Island Dam was developed For consistency with the goal, the escapement time series reported here was changed to the total adult Rock Island Dam count The terminal run is that reported for Upriver Summer Chinook in the Joint Staffs Reports as the Bonneville Dam Count plus catch in lower river fisheries These were also changed to include both hatchery and wild returns, where previously only naturally spawning returns were reported

[2]Number of naturally spawning adult fish in the Lewis River The total run is escapement plus the Lewis River sport catch of wild adults

[3] The first column gives the estimate based on a mark-recapture project for the entire river, which was used to verify the Sherar's Falls estimates The second column is the estimate based on using the ratio of redds above and below Sherar's Falls The time series of data through 2009 were updated based on a comprehensive analysis done by Warm Springs, ODFW and CRITFC staff (Sharma et al 2010)

[4] The CRFMP stated an interim escapement goal of 40,000 natural spawning URBs at McNary Dam, including 38,700 for Hanford Reach and 1,100 Snake River In 1990, the escapement goal was increased to 45,000 for increased hatchery programs In 1994, a management goal of 46,000 was established, and in 1995, the management goal was retained while the escapement goal was reduced to 43,500 In 2002, the CRFMP escapement goal of 40,000 was agreed to by the CTC Escapement numbers given are McNary adult dam count minus adult sport and broodstock above the dam The terminal run is the Columbia River mouth terminal run of Upriver Brights minus the Deschutes River fall chinook terminal run

Appendix B.8. Oregon Coastal escapements as estimated via traditional habitat expansion methods and terminal runs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Oregon Coastal							
	Nehalem R.		Siletz R.		Siuslaw R.		Coquille R.	
	esc.	tot. run	esc.	tot. run	esc.	tot. run	esc.	tot. run
1975	5,197	5,303	2,062	2,689	4,427	4,548	4,927	NA
1976	9,807	9,908	1,326	2,036	7,999	8,153	2,188	NA
1977	11,478	12,093	3,314	3,919	9,492	10,362	4,379	NA
1978	12,059	12,244	2,062	3,700	5,872	6,879	3,951	5,290
1979	12,205	12,469	7,217	8,907	8,040	8,799	4,030	4,715
1980	5,555	5,832	3,680	4,820	10,630	11,183	4,014	4,622
1981	10,752	10,939	4,435	6,751	8,724	9,342	4,313	4,996
1982	5,085	5,282	3,415	4,514	10,870	11,774	6,249	6,865
1983	4,431	4,525	2,136	3,152	4,186	4,885	3,193	3,807
1984	20,341	21,623	3,461	4,552	11,168	12,437	4,502	5,164
1985	18,670	19,473	6,628	7,685	14,822	15,805	3,157	3,853
1986	10,389	11,920	6,748	7,799	14,844	15,965	4,470	5,125
1987	13,560	15,725	4,577	6,023	17,603	19,411	5,640	6,997
1988	14,889	17,185	7,805	9,257	41,746	44,380	7,451	8,635
1989	10,389	12,000	4,401	5,980	28,279	31,690	6,462	7,820
1990	5,104	6,789	4,313	5,373	26,799	29,593	6,064	7,567
1991	5,557	7,685	5,633	6,926	26,100	29,825	9,074	11,470
1992	9,060	11,863	6,044	7,460	26,090	28,350	13,293	15,911
1993	5,345	9,317	4,342	6,506	10,446	14,012	6,993	10,419
1994	6,486	9,412	10,475	12,188	23,570	25,890	6,698	8,696
1995	5,194	8,845	5,164	8,045	26,715	31,194	7,885	10,374
1996	9,211	13,285	7,394	10,274	33,051	39,705	6,346	8,790
1997	10,026	13,069	3,726	6,165	22,305	27,516	6,743	8,338
1998	8,245	10,869	5,516	7,175	24,708	28,882	9,930	12,680
1999	8,063	10,632	4,166	6,232	23,963	27,271	8,513	10,950
2000	6,855	9,119	6,787	9,462	15,730	19,588	6,684	8,974
2001	11,662	15,998	10,563	14,704	38,717	43,836	8,233	12,007
2002	18,089	22,657	14,054	19,019	41,058	47,905	11,848	15,578
2003	10,906	15,095	11,149	15,693	58,998	66,246	16,482	21,572
2004	9,975	14,792	3,902	10,419	40,033	46,062	11,346	14,041
2005	8,114	9,535	6,631	8,931	17,618	19,301	5,029	5,767
2006	4,711	5,902	4,108	6,194	28,082	29,926	3,009	3,790
2007	4,304	5,759	528	1,536	6,764	9,665	2,098	3,557
2008	3,810	4,865	1,202	1,682	11,119	12,405	4,562	5,813
2009	4,070	4,070	2,905	3,343	14,094	15,881	12,308	13,530
2010	5,384	7,254	4,225	5,118	22,197	25,846	32,318	NA
2011	7,665	9,780	3,638	5,861	30,713	NA	16,745	NA
Goal	6,989		2,944		12,925		pending	

Appendix B.9. Oregon Coastal escapements and terminal runs as estimated by mark-recapture calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Oregon Coastal						
Year	Nehalem R.		Siuslaw R.		Umpqua R. S. Fork	Coquille R.	
	esc.	tot. run	esc.	tot. run	esc.[1]	esc.	tot. run
1975	4,954	5,060	2,567	2,567	NA	6,668	NA
1976	9,345	9,446	4,565	4,565	NA	2,766	NA
1977	10,937	11,552	4,531	4,531	NA	5,676	NA
1978	11,491	11,676	2,867	3,874	400	5,618	6,957
1979	11,794	12,058	3,554	4,313	NA	5,203	5,888
1980	5,368	5,645	5,483	6,036	697	5,952	6,560
1981	10,390	10,577	3,767	4,385	890	6,405	7,088
1982	4,914	5,111	5,094	5,998	1,011	8,885	9,501
1983	4,282	4,376	923	1,622	1,628	4,686	5,300
1984	19,657	20,939	3,384	4,653	2,594	6,229	6,891
1985	18,042	18,845	6,845	7,828	2,246	4,498	5,194
1986	10,039	11,570	6,513	7,634	1,573	5,642	6,297
1987	13,103	15,268	5,568	7,376	2,795	6,429	7,786
1988	14,388	16,684	14,935	17,569	3,778	8,389	9,573
1989	10,039	11,650	12,856	16,267	6,162	6,948	8,306
1990	4,932	6,617	13,662	16,456	3,761	7,738	9,241
1991	5,370	7,498	15,709	19,434	6,717	10,508	12,904
1992	8,755	11,558	13,221	15,481	8,149	16,636	19,254
1993	5,165	9,137	2,960	6,526	3,364	7,446	10,872
1994	6,268	9,194	9,477	11,797	7,128	6,866	8,864
1995	5,020	8,671	10,246	14,725	11,388	12,060	14,549
1996	8,901	12,975	15,788	22,442	10,019	7,618	10,062
1997	9,689	12,732	8,313	13,524	7,286	8,580	10,175
1998	7,967	10,591	5,456	9,630	1,104	11,877	14,627
1999	7,792	10,361	11,785	15,093	1,804	10,653	13,090
2000	8,553	10,817	4,648	8,506	3,140	7,880	10,170
2001	9,957	14,293	16,814	21,933	6,510	12,512	16,286
2002	15,984	20,552	19,400	26,247	3,831	13,675	17,405
2003	19,380	23,569	24,596	31,845	8,918	18,876	23,966
2004	9,639	14,456	22,596	28,625	7,487	11,668	14,363
2005	6,801	8,222	14,884	19,301	3,084	5,438	6,176
2006	11,938	13,129	6,965	7,696	2,396	7,438	8,219
2007	5,193	6,648	1,491	4,154	2,457	2,098	4,037
2008	4,596	5,651	2,617	3,484	2,333	5,803	7,661
2009	5,332	5,332	3,301	5,087	3,014	15,653	16,875
2010	7,250	9,120	5,160	8,808	6,184	41,104	NA
2011	11,143	13,258	7,436	NA	7,550	21,291	NA
Goal	pending		pending		pending	pending	

[1]Preliminary analysis has shown that terminal catch of South Fork Umpqua River fall Chinook salmon is negligable

Appendix C. Sentinel Stocks Program in 2011

The Sentinel Stocks Committee (SSC) of the Sentinel Stocks Program (SSP) met in Seattle during December 2010 to review progress for projects funded in 2010 and to develop a request for proposals for projects in 2011. In response, the SSC was provided with 15 proposals for work in 2011. The SSC met in Vancouver from 24-26 January 2011 to review proposals and 10 of the 15 submitted proposals were recommended for SSP funding in 2011. A proposal to estimate escapement of Chinook in the Moheya River (WCVI) was among the five proposals not recommended for funding; however, the SSC recommended using unexpended funding for the Moyeha River work in 2010 to assess cost-effective catch rates of Chinook in the Moyeha River in 2011. In February 2011, the Pacific Salmon Commission approved funding for all 10 proposals. The proposals were chosen as per the approach outlined in the directive from the Commission to the SSC entitled *Implementation Approach for the Chinook Sentinel Stocks Program, October, 2008* and the *Sentinel Stocks Program Second Stage Proposal Evaluation, February, 2009*. Recommended proposals represented stocks in all five regions specified in the directive (North Oregon Coast, Puget Sound, Fraser River, west coast of Vancouver Island, and Northern British Columbia). The stocks recommended for study in the SSP are of significant importance to the management of fisheries for Chinook salmon under the Pacific Salmon Treaty.

During their deliberations in February 2011, the Pacific Salmon Commission asked the SSC to consider revised proposals for additional work on WCVI Chinook salmon escapements in 2011. A revised proposal for the Kaouk River was accepted by the SSC during a teleconference in April 2011. The SSC again recommended use of unexpended prior year funds to evaluate catch rates in the Moyeha River. The Pacific Salmon Commission subsequently approved the recommendation to fund the Kaouk River work as well as the use of unexpended prior year funding for further work on the Moyeha River. Final funded projects and budget amounts for the 2011 SSP are summarized in Appendix Table C-1. Summaries of results from these funded projects are provided in the narratives below.

Appendix Table C.1. Projects and funding levels for the Sentinel Stocks Program in 2011.

Stock Group	Stock	Title	2011 Funding
Oregon Coast	Nehalem R.	Nehalem R. Chinook Escapement Enumeration	$305,300
Oregon Coast	Siletz R.	Siletz River Chinook Escapement Enumeration	$223,600
Puget Sound	Green R.	Abundance Estimate for Green River Chinook	$139,600
Puget Sound	Stillaguamish R.	Abundance Estimate for Stillaguamish Chinook	$117,300
WCVI	Burman R.	Burman River Chinook Escapement Estimation	$98,500
WCVI	Kaouk R.	Kaouk River Chinook Escapement Estimation	$225,000
WCVI	Moheya R.	Chinook Catch Rates in Moyeha River	$64,977
Fraser	S. Thompson R.	Abundance Estimate S. Thompson Aggregate	$169,000
Fraser	Chilko R.	Chilko River Chinook Mark-Recapture	$226,100
NBC	Nass R.	Estimate of Aggregate Population in Upper Nass	$105,300
NBC	Skeena R.	Escapement Estimation of Skeena River w/ GSI	$25,100
NBC	Skeena R.	Retrospective Escapements of Skeena R. w/ GSI	$125,000

Refer to List of Acronyms for definitions.

Nehalem and Siletz River Chinook Escapement Enumerations, 2011

The Siletz and Nehalem populations of fall Chinook salmon are part of the Northern Oregon Coast (NOC) aggregate. The Nehalem basin is located at the far north of the NOC aggregate, while the Siletz basin is located approximately midway within the NOC aggregate of stocks. The NOC aggregate has historically been a very productive, resilient stock complex; however failures to reach escapement goals in the late 2000's prompted the need to better quantify performance of this group. The prior ten-year average (2001-2011) of adult spawning escapement in the Siletz River was 5,234 individuals. In the Nehalem River, the prior ten-year average (2001-2011) was 7,835 adult Chinook salmon.

Under the SSP, the ODFW estimated spawning escapement using standard mark-recapture methods. Adult fish were captured upon return to each basin using tangle nets in both basins and a modified fish ladder on the Nehalem River. Fish were marked using operculum punches, the location of which was varied to represent different time frames of freshwater entry. A second capture event(s) occurred on the spawning grounds. Surveys were conducted in select reaches by foot or by boat and counts of live fish, carcasses, and redds were made. Carcasses were examined for marks and biological data was collected (e.g., length, sex, scales, and other marks). In 2011, a mark-recapture study was also implemented on the North Fork Nehalem. The mouth of the North Fork is below the usual marking location on the mainstem (or South Fork) Nehalem. Chinook salmon were captured and marked in the North Fork using tangle nets; however, the recapture events included both spawning ground surveys and ongoing trapping activities at Waterhouse Falls near the NF Nehalem Hatchery.

The likelihood that mark-recapture assumptions were violated was evaluated using chi-square analyses and Salmonid Population Analysis Software (SPAS). Depending on the

results of these tests and the data collected, the best estimation techniques for the data were applied. Tests were conducted for size bias using Kolmogorov-Smirnov tests on the cumulative distribution function for adults. Population size was estimated from mark-recapture data in the Siletz basin using the Chapman version of the Petersen equation. A stratified estimator (Darroch maximum likelihood, SPAS software) was used to derive a total estimate for the Nehalem basin. The stratified estimator was used for the Nehalem because of interest in knowing the relative contribution of the early and the late runs of fall Chinook in the basin. Further, a distinct stratification by location and date of freshwater entry was noted. Strata were chosen to represent differences in terms of timing of freshwater entrance and spawning location.

Creel surveys were conducted in both the Siletz and Nehalem basins. The intent of these surveys was to both identify instances when marked fish were removed from the system and to generate timely and robust estimates of terminal harvest(s).

Historically, the ODFW estimated Chinook salmon escapements in Oregon coastal basins using habitat-expansion methodology. Agency employees conducted, and continue to conduct, standard spawning ground surveys to record live and dead counts of Chinook salmon. Then, the largest daily sum of live and dead counts for a given survey location (the peak count) was identified, and an index calculated (number of fish per mile). Next, the index is expanded by the total estimated available spawning habitat in each basin (in miles). Additional procedures are used to adjust for observation error and non-random bias. Agency personnel have calculated estimates using these traditional methods while concurrently conducting mark-recapture experiments in the Siletz basin since 2005 (Appendix Table C.2) and in the Nehalem basin from 2000 to 2003 and from 2009 to 2011 (Appendix Table C.3).

Appendix Table C.2. Siletz River: Comparisons of Chinook salmon escapement estimates between traditional habitat expansion methods and mark-recapture techniques with associated coefficient of variation (CV).

Run Year	Traditional Estimate	Standard Survey Index (fish/mile)	Mark-Recapture Estimate	CV of MR Estimate
2005	6,631	53	14,355	63%
2006	4,108	49	15,891[a]	21%
2007	528	5	2,625	16%
2008	1,203	10	1,202	20%
2009	2,905	24	2,213	12%
2010	4,225	35	10,985	43%
2011	3,638	26	4,985	7%

[a]Value reflects a stratified Darroch estimate, additional analyses required to assess the influence of potential biases on the accuracy of the estimate.

Appendix Table C.3. Nehalem River: Comparisons of Chinook salmon escapement estimates between traditional, habitat expansion methods and mark-recapture techniques with associated coefficient of variation (CV).

Run Year	Traditional Estimate	Standard Survey Index (fish/mile)	Mark-Recapture Estimate	CV of MR Estimate
2000	6,855	56	10,678	26%
2001	11,662	96	12,431	12%
2002	18,089	112	19,956	5%
2003	10,906	87	21,283	22%
2009	4,070	29	5,786	18%
2010	5,384	31	7,097	12%
2011	7,665	46	11,084	14%

A total of 444 wild adult Chinook salmon in the Siletz River basin were marked during the 2011 return year. A total of 1,565 wild adult carcasses were recovered on the spawning grounds; 128 of which were marked (~29% recovery rate). The escapement population size was estimated using the Chapman version of the Petersen estimator at 5,401 fish (S.E. 382). The coefficient of variation is 7%, well within acceptable CTC data standards. The 2011 sportfishing regulations allowed for angling above the marking site. Therefore, the estimated harvest above the marking site of 416 Chinook salmon was subtracted from the estimate. This provides an adjusted estimate of 4,985 spawning adult Chinook salmon in the Siletz River.

In the Nehalem River basin in 2011, a total of 473 wild adult Chinook salmon were marked. Two marked Chinook were observed in the creel so for analysis purposes 471 marked fish were used. A total of 1,502 qualifying carcasses on the spawning grounds were sampled and of those, 63 were marked fish. This represents a 13% recovery rate. An estimate was produced using the Darroch maximum likelihood estimator of 11,143 wild adult fish with a standard error of 1,537. The stratified estimate has a coefficient of variation of 14%.

In the North Fork Nehalem, a total of 52 wild adult Chinook were marked. During the second event, 287 fish were examined with nine recaptures. Abundance was estimated to be 1,525 adult Chinook salmon with a pooled Petersen estimate (S.E.=407). The coefficient of variation is 27%. The escapement estimate should be adjusted for harvest above the marking location. Harvest was estimated to be 200 adult Chinook salmon, reducing the escapement estimate to 1,325 Chinook salmon.

Previous studies in the Siuslaw, Coos, Coquille and Salmon Rivers explored the use of a visual index gathered from the spawning ground surveys to represent an accurate and relatively precise estimate of spawner abundance. Various survey indices, including but not limited to peak counts of live fish, expansion of live counts with an area-under-the-curve (AUC) method, counts of redds, and a sum of counted carcasses were calibrated to mark and recapture derived escapement estimates to determine which index tracts best over a period of years. Results from these studies suggest that peak counts are the most consistent indicator of abundance, but all could have some merit. More importantly, these studies indicate that the indices derived using counts from both mainstem and tributary habitat correlated best. Given future and current constraints around personnel and

funding resources, this research has focused on identifying surveys of high Chinook salmon densities from both mainstem and tributary reaches where peak counts or other indices are most likely to adequately track abundance.

Preliminary calibration of spawning ground surveys and mark-recapture experiments from the Nehalem and the Siletz River basins have been conducted. Values presented as "calibration value" represent the visual index divided by the mark-recapture estimate. The ideal conversion factor would have an inter-annual coefficient of variation (CV) of 0 if it tracks perfectly with changes in abundance (Appendix Table C.4). Variability in the inter-annual coefficient of variation is likely underestimated as this descriptive statistic does not incorporate the precision of the population estimate used, nor does it incorporate the variability within the survey index. Results from standard survey calibration efforts using peak counts in the Nehalem river basin suggest a relatively strong relationship (CV of 24%). Bias detected in some of the mark and recapture estimates may exclude these abundance estimates from the calibration, thus additional studies may be necessary to improve confidence in the index relationship. The relationship of visual indices from Siletz River standard surveys does not correlate well with the mark-recapture estimates. A plausible hypothesis for the poor correlation is that the standard surveys in the Siletz represent smaller, tributary type habitat which is not typically productive Chinook salmon habitat. In basins where the relationship between the standard surveys and the mark-recapture estimate is strong (i.e. Siuslaw and Salmon rivers), the standard surveys occur in habitats more typical of Chinook salmon spawning habitat. All of the standard surveys in the Siletz River are located in small tributary reaches, and this factor may explain the poor calibration results. Fortunately, some select main stem surveys in the Siletz basin have been located where visual indices of abundance used in conjunction with tributaries appear to track abundance far better than the standard surveys. At this point, a peak count index and the sum of dead index from three surveys totaling 3.2 miles seems to be a relatively good indicator of abundance in the basin (Appendix Table C.5). Therefore, with support through SSP funding, survey design and estimation methods are continued to be explored that use both main stem and larger tributary reaches outside the historical standard survey design.

Appendix Table C.4. Calibration of index values from Chinook salmon (>600mm) encountered on standard spawning ground surveys to mark-recapture estimates in the Nehalem River basin. The index value is an annual average from four surveys totaling 3.5 miles. The calibrated index CV represents the variation around the calibration value over the seven years of study. The fish/mile index represents the average from all surveys of the maximum sum of live and dead fish encountered on a given day.

Year	Traditional Estimate	Mark-Recapture Estimate	CV of Mark-Recapture Estimate	Index (fish/mile)	Calibration value (fish/mile)
2000	6,855	10,678	26%	56.0	0.00524
2001	11,662	12,431	12%	95.8	0.00770
2002	18,089	19,956	5%	112.3	0.00563
2003	10,906	21,283	22%	86.5	0.00406
2009	4,070	5,786	18%	29.1	0.00503
2010	5,384	7,097	12%	31.0	0.00436
2011	7,665	11,084	14%	46.1	0.00416
			Calibrated	Index CV	24.4%

Appendix Table C.5. Calibration of index values from Chinook salmon (>600mm) encountered on select spawning ground surveys to mark-recapture estimates in the Siletz basin. The calibrated index CV represents the variation around the calibration value over the seven years of study. The fish/mile index represents the average from all surveys of the maximum sum of live and dead fish encountered on a given day.

Year	Traditional Estimate	Mark-Recapture Estimate	CV of Mark-Recapture Estimate	Index (fish/mile)	Calibration value (fish/mile)
2005	6,631	14,355	63%	84	0.00585
2006	4,108	15,891	21%	131	0.00824
2007	528	2,625	16%	26	0.00990
2008	1,203[a]	1,202	20%	16	0.01331
2009	2,905	2,213	12%	24	0.01085
2010	4,225	10,985	43%	42	0.00382
2011	3,638	4,985	7%	48	0.00963
			Calibrated	Index CV	36.0%

The ODFW anticipates identifying a cost effective spawning ground survey design in which one or more of the measured metrics accurately and precisely represent Chinook escapement for the basin within the data standards developed by the CTC. The current focus is to increase the proportion of mainstem type habitat surveyed. The ODFW intends to survey these reaches annually. The approach will require multiple years of statistically sound mark and recapture experiments before a complete assessment of survey results can be performed with acceptable levels of certainty. The ODFW is also exploring a weighted least squares regression approach to determine the relationship between a visual

index and the mark and recapture estimates of abundance. This technique may allow researchers to include study years where the abundance estimates did not meet the precision standards necessary for the calibration approach. The ODFW anticipates that annual escapements could be estimated from the regression equation and confidence bounds derived using peak count data.

Abundance Estimate for Green River Chinook, 2010

The Green River summer/fall Chinook salmon population is one of five stocks in Puget Sound used by the CTC as an escapement indicator for Puget Sound Natural Summer/Fall Fingerlings. Escapement indicator stocks monitor the effectiveness of the management regimes and, if necessary, their status may trigger additional management actions in AABM and ISBM fisheries. Based on redd count surveys, the 2000–2009 average estimated escapement in the Green River was 6,118 Chinook salmon.

The WDFW estimated the abundance of Chinook salmon spawning in the Green River using genetic based Lincoln-Petersen mark-recapture abundance estimators (GMR). Spawning adults were 'marked' by obtaining a DNA microsatellite profile from tissue sampled from adult carcasses. Marks were later 'recaptured' by sampling out-migrating smolts ('captures') and genetically identifying some fraction of marks as parents of some out-migrating offspring. Tissue from 266 adult carcasses (marks) was collected in fall 2010. Tissues from ~9,000 migrating smolt spawned in fall 2010 were collected in spring of 2011 at a smolt trap just upstream of Soos Creek. Adult marks and a representative subsample (n = 2,000) of juvenile captures were genotyped at 14 microsatellite DNA loci. Using the likelihood algorithms found in the software COLONY, the genetic data were used to match parents to offspring inferring recaptures. The counts of marks, captures (genotyped juveniles times 2), and recaptures were then used in a Petersen mark-recapture estimate of spawner abundance based on binomial sampling. COLONY infers unsampled parents allowing identification and enumeration of unique captures and unique recaptures. These were used in a hypergeometric Petersen mark-recapture estimate of spawner abundance and in an accumulation curve estimate of the number of successful breeders.

Adjustments to the initial abundance estimates were necessary for two reasons. First, some unknown, but likely a very small number of unmarked hatchery-produced juveniles escaped from one or both of the hatchery acclimation ponds upstream of the smolt trap and were caught in the smolt trap, inflating capture numbers of naturally produced juveniles and the abundance estimate. Second, some adults spawned downstream of the smolt trap, so their offspring were not sampled. The WDFW made both adjustments using Bayesian modeling methods. The capture number was adjusted using estimated hatchery adipose fin clipping rates derived from subsamples of the hatchery populations and the catch of marked hatchery-produced juveniles at the trap. Abundance estimates were expanded to the main stem Green River downstream of the smolt trap by using the proportion of totals redds found upstream of the smolt trap in a basin wide redd survey during statistical week 40.

The WDFW obtained genotypes for 232 marks, 3,892 captures (1,946 juveniles), and, through parentage analysis, 222 recaptures. Using these counts, the WDFW obtained preliminary adjusted estimates of Chinook salmon spawner abundance. The spawner abundance estimate for upstream of the smolt trap was 4,070 (95% CI = 3,406-4,865) and expanded to below the smolt trap the estimate was 4,541 (95% CI = 3,778-5,471; Appendix Table C.6). The CTC performance standards were met with GMR for 2010 (CV < 15%). Abundance estimates from GMR were roughly double the 2010 estimate made using redd counts, which was similar to patterns seen with traditional mark-recapture estimates made in previous years (Appendix Table C.6). The WDFW also generated accumulation curves and used a hypergeometric method to estimate spawner abundances and compared methods to the binomial method. Results were comparable for all methods and will be detailed in the final report.

Appendix Table C.6. Mark-recapture estimates of Chinook salmon spawner abundance in the Green River. Estimates for brood year 2010 are preliminary results of the binomial GMR estimator from the present study.

Brood Year	Spatial Extent	Mark-Recapture Abundance Estimate	CV (%)	Redd Count Based Abundance Estimate
2000	Entire Green River	10,206[a]	14.2	4,473
2001	Entire Green River	21,402[a]	7.0	6,473
2002	Entire Green River	14,857[a]	8.7	7,564
2010	Upstream of smolt trap	4,070	9.1	NA
2010	Entire Green River	4,541[a]	9.5	2,092

[a] The Chinook salmon abundance estimates for the Green River do not including Soos Creek because this creek is composed of a very high proportion of hatchery origin spawners.

Abundance Estimates for Stillaguamish River Chinook, 2007-2010

Stillaguamish River Chinook salmon are one of seven escapement indicator stocks in Puget Sound used by the CTC. Escapement indicator stocks reflect effectiveness of management regimes and, if necessary, their status may trigger additional management actions in AABM and ISBM fisheries in the U.S. and Canada. Stillaguamish River Chinook salmon are of concern due to declines from historic levels, current low abundance and resultant limitations this imposes on fisheries management. In addition, this stock was identified as a sentinel stock in the latest Pacific Salmon Treaty. Estimates for historic returns ranged from 9,700-13,321 Chinook salmon per year as compared to an average of 1,080 in more recent years (1996-2003). Although their overall harvest rate is the lowest of all CTC indicator stocks, from 1999-2006 the mean Canadian exploitation rate for this stock was ~15%, which was nearly double the exploitation rate in Southern United States fisheries (8.1%).

The SSP funded a study design to estimate Chinook salmon spawning escapements using a GMR protocol employing genotypes from carcasses collected in the fall and out-

migrants captured via smolt trapping during the following winter and spring. The WDFW assigned smolts collected in the main stem in the years 2008-2011 to their parents (natural spawners collected in the years 2007-2010, each juvenile set was assigned to its respective potential parent group). Using a pooled Lincoln-Petersen estimate methodology (genotyped spawners = marks, genotyped out-migrating juveniles = captures, and juveniles assigned back to spawners = recaptures). The WDFW calculated spawner abundance in each of four years and compared these abundance estimates to estimates derived from redd count expansions (Appendix Table C.7). In brood years 2007 and 2010, the GMR estimates were substantially higher than redd estimates whereas in brood years 2008 and 2009, the GMR and redd estimates were closer.

Stillaguamish Chinook salmon juveniles presented challenges to the GMR study design with unmarked hatchery juveniles (juveniles leaving the hatchery upstream of the smolt trap with adipose fins intact) and yearling juveniles (juveniles leaving the system after 14 months, rather than two months) in the smolt samples. If unaccounted for, unmarked hatchery juveniles and yearlings would inflate abundance estimates since they increase capture numbers yet have no possible parents in the "Mark" pool. The WDFW identified unmarked hatchery juveniles by assigning smolts to hatchery broodstocks for their respective brood years and removed them prior to analyses. The WDFW identified yearlings by regressing smolt lengths on capture dates and observing outlier smolts – smolts that were much longer than average smolt lengths for each time strata – and removed them from analyses. Since there were few spring Chinook salmon yearlings and unmarked hatchery fish, both of these adjustments resulted in small changes in the GMR estimates. The preliminary GMR results presented here include corrections for unmarked hatchery juveniles and yearlings.

This GMR study was opportunistic in that it used genetic samples collected to evaluate genetic differences between the North and South forks of the Stillaguamish River. Even though this study was opportunistic, the CV based on Bailey's binomial model, was higher than the CTC standard of 15% in only one of four years (Appendix Table C.7).

Appendix Table C-7. Preliminary spawner abundance estimates for Stillaguamish River Chinook salmon for brood years 2007-2010 using genetic mark-recapture (GMR). Genotyped spawner carcasses are under "Marks", genotyped out-migrating juveniles are under "Captures", juveniles assigned to a spawner are under "Recaptures", and the coefficient of variation for the GMR estimate is under "CV". Redd-based abundance estimates were from expanded redd counts.

Brood Year	Genotyped Spawners (Marks)	Genotyped Juveniles (Captures)	Juveniles Assigned (Recaptures)	GMR Estimate	GMR CV	Redd Estimate
2007	33	484	16	1,881	23%	607
2008	70	747	56	1,836	13%	1,671
2009	120	1,202	259	1,110	6%	1,001
2010	52	544	40	1,381	15%	783

Moyeha River Chinook, Estimation of Catch Rates 2011

Moyeha River Chinook salmon contribute to AABM and ISBM fisheries. The Moyeha River is located in Strathcona Park, Clayoquot Sound, on the West Coast Vancouver Island. The Moyeha River was added as a Sentinel Stock in 2010 because: (1) habitat in the Moyeha River watershed is pristine and untouched by development; (2) the population has never been deliberately supplemented with hatchery fish; and (3) the stock is one of the eleven stocks used as a secondary index to gauge strength of the overall WCVI annual escapement. Escapement to the Moyeha River is typically monitored with area-under-the- curve methods based upon multiple swim surveys; from 2000 through 2009, these methods estimated average escapement to be 130 Chinook salmon. The 2011 project objective was to measure CPUE for various capture methods including beach seining, tangle netting, angling, and carcass recovery to determine if catch rates were sufficient to provide a defensible mark-recapture estimate in future years. Additional objectives were to obtain samples to estimate age, sex, size, and origin composition of the escapement..

A seine net was deployed in the Moyeha River from RKM 2.25, RKM 2.50, and RKM 3.00 within staging pools using a 14 foot flat-bottom boat powered by a 25 hp jet motor or 9.9 hp motor. Tangle netting was conducted between RKM 1.50 to RKM 2.50 during the day and night. The tangle net was stretched across the full width of the river to sample salmon swimming up or retreating down the river. Angling with a rod and reel using salmon roe as bait was conducted from RKM 9.00 down to the entrance of the river. Anglers would walk the river banks or utilized a rubber raft to float down the river after being dropped off in the upper section of the river by a helicopter.

All species captured during the seining, tangle netting or angling events were recorded. Carcass surveys were conducted over the entire anadromous reach from RKM 13.50 to the river mouth. Surveyors swam the river and walked the river banks to maximize carcass recovery. Live Chinook captured were tagged with numbered Kurl-lock tags and a mutilation mark was applied to the operculum. Chinook salmon were also visually identified for gender. For all Chinook salmon sampled, the lengths were measured to the nearest 5 mm and scales were obtained for aging. Tissue samples were collected from the operculum and preserved in 95% ethanol to contribute to the coastwide GSI database. For carcasses, biological samples included otoliths to determine origin. The gender was verified by cutting open the fish and examining its internal organs. Egg retention for females was estimated to assess handling stress.

Catches of Chinook salmon were meager. Beach seining was more successful as a method of capture compared to tangle netting or angling. There were three Chinook salmon obtained by beach seine on a total of eight days (CPUE = 0.375 per day). There were no Chinook salmon captured by tangle netting or angling although other species such as chum salmon, coho salmon and trout were captured by these methods. There were nine samples obtained from the carcass surveys with no recaptures. The age structure proportions were 10% age 3, 80% age 4, and 10% age 5. The three Chinook

salmon captured by beach seine were all males. The ratio of males to females sampled during the carcass recoveries was 3:1. Origin analysis showed that all Chinook sampled (n = 9) were of wild origin. The normative area-under-the curve estimate in 2011 from the snorkel surveys provided by DFO was 60 large Chinook with a peak observation of 44 individuals. A survey life of 25 days was used and the observer efficiency was estimated on a per section basis ranging between 90% and 95%.

A mark-recapture program is not feasible while the Moyeha River population remains at very low apparent abundance. Recommendations for future work include, continued non-invasive monitoring of the population, increasing and not reducing the frequency of swim surveys to obtain more precise estimates of escapement; carcass surveys and biological sampling should be continued to monitor potential hatchery stray contributions.

Kaouk River Chinook Escapement Estimation, 2011

In 2011, the Ka:'yu:'k't'h'/Che:k:tles7et'h' First Nations (KCFN) and LGL Limited (LGL) conducted a project to assess the escapement of adult Chinook salmon returning to the Kaouk River, located in Kyuquot Sound on the west coast of Vancouver Island, B.C. The objectives of the project were: (1) to estimate the total in-river escapement of age 3 and older Chinook salmon in the Kaouk River such that the CV was 15% or less; and (2) to estimate the size, sex, and age composition of age 3 and older Chinook salmon in the Kaouk River such that all estimated fractions were within 10% of the true values 95% of the time. From 31 August to 6 October 2011, 26 beach seine sets and 14 tangle net sets were made at five different sites in the main stem Kaouk River (RKM 3.90-9.90). Sixty-nine live unmarked adult Chinook salmon were captured from 1 September to 6 October, of which 63 were radio-tagged (36 with motion-sensing tags), 3 were spaghetti-tagged, and 3 were released untagged. Four (6.5%) of the 62 radio-tagged fish detected at least once were tracked to locations outside of the typical DFO swim survey area (two upstream of marker 17 in the main stem Kaouk River and two in Rowland Creek). Survey life for radio-tagged fish averaged 18.0 days (SD = 6.6) and ranged from 7.1 to 38.3 days (median = 16.9; n = 46). Swim surveys by KCFN/LGL and DFO-contracted crews were conducted from 17 August to 7 November with a peak count of 208 Chinook salmon occurring on 30 September. Due to temporal and spatial overlap of the mark and recovery events, and the inability to sample fish in September and October due to high water levels and the presence of a large number of co-migrating coho and chum salmon, a reliable mark-recapture estimate could not be generated. Using area-under-the-curve methods, the estimated escapement of adult Chinook salmon to the Kaouk River was 256 fish (95% confidence bounds: 223 to 288 fish). The majority of fish were age 4 (69.6%), followed by age 3 (19.6%) and age 5 (10.9%) fish. Using DNA analysis to determine sex, the ratio of males to females was 1.72:1. Male and female fish averaged 81.4 and 83.6 cm FL, respectively.

Burman River Chinook Escapement Estimation, 2011

The WCVI fall Chinook salmon stock aggregate is an important production group contributing to catches in AABM and ISBM fisheries. The Burman River Chinook salmon population is an escapement indicator population as described in the Chinook Chapter of the Pacific Salmon Agreement in Attachments I-IV. Escapements to the Burman River are summed along with the estimated escapements to five other streams to produce a six-stream index representing WCVI escapement trends. The Burman escapement estimate is also summed in a second larger index that includes eight additional WCVI streams. Exploitation of the aggregate is assumed to be represented by the Robertson Creek Hatchery CWT exploitation rate indicator stock. Low stock status in the stock group has prompted fishing restrictions in Canadian fisheries since 1995. More recently, conservation concerns for the WCVI stock group, among other issues, led to a 15% reduction in the Chinook salmon catch levels in SEAK. Over the 10 year period of 1999-2008, escapements to the Burman River averaged 841 adult Chinook salmon based upon area-under-the-curve swim survey methodology.

The abundance of Chinook salmon that returned in 2011 to the Burman River was estimated with a conventional 2-event Petersen mark-recapture experiment. Chinook salmon were captured and marked using a beach seine in the lower river staging area below the counting sections and by recovering carcasses. All biological samples were collected while marking or during carcass recoveries as no hatchery brood were collected in 2011. All Chinook salmon captured were marked with two individually numbered #3 Kurl-lock tags attached to the opercula and a secondary mutilation mark. Fish were identified by gender, and post-orbital hypural length was measured. Scales were collected for ageing and otoliths were recovered from carcasses to determine origin.

A total of 894 adult Chinook salmon (382 females and 512 males) were marked in the lower river between September 12 and October 9. Forty-one marked animals (21 females and 20 males) were encountered among 295 carcasses (153 females and 142 males) recovered between Sept 19 and November 7. The preliminary resulting pooled Petersen estimate of > age-3 and older Chinook salmon (> 500 mm) was 6,307 fish (SE = 870, CV = 14%). The CV of the 2011 estimate met the CTC data standard; CVs of estimates from 2009-2011 have averaged 15%.

Statistical tests for size selectivity (all marked and all carcasses: $D_I = 0.167$, $P = 0.991$; all marked and all marked carcasses: $D_I = 0.273$, $P = 0.736$ from Kolmogorov-Smirnov two-sample tests) and gender selectivity ($\chi^2 = 1.22$, $df = 1$, $P = 0.269$) indicated the population of fish marked in the lower river and recovered as carcasses were the same and samples were unbiased. However, bootstrapping with 1,000 resamples of the mark-recapture data produced a bi-modal distribution suggesting stratification was required. Bootstrapping gender stratified recapture data indicated the issue originated among the female mark-recapture data. A time stratified Pooled Petersen estimate for females produced with Stratified Population Assessment program (Arnason et al. 1996) was 2,582 adult females (SE = 446, CV = 19%), near the median of 1,000 bootstrap resample estimates of the simple Petersen estimate. The bias in the initial female estimate appears to have been caused by an unequal tagging rate during the high flow period. The estimate

for adult males was 3,004 (SE = 571, CV = 19%). The total escapement estimate for adult Chinook salmon was 5,384 (SE = 733, CV= 14%). No animals were removed by the hatchery program in 2012.

The ratio of males to females was 1.29:1.00. The age structure was 7.7% age-3 fish (2008 BY), 88.4% age-4 fish (2007 BY), 3.5% age-5 fish (2006 BY), and 0.35% age-6 fish (2005 BY) from an overall sample size of 285 Chinook salmon.. Origin composition estimated from examination of 271 otolith samples for hatchery specific thermal marks were 2.9% natural (6 unmarked and 2 overgrinds), 96.7% local hatchery, and 0.4% stray (a single stray from Robertson Creek Hatchery). Given the escapement estimate, the number of naturally produced spawners was about 153 animals in 2011.The preliminary DFO area-under-the curve (AUC) index escapement estimate was 2,000 Chinook salmon and was not expected to track actual abundance in 2011. The "peak observation" for the normative AUC estimate in 2011 missed the peak of the run due to prolonged high flows during the peak time of spawning. On open population estimate using POPAN in Program MARK will be provided in the final report.

Abundance Estimate South Thompson Aggregate, 2011

A Bayesian model was developed to estimate the escapement of an aggregate salmon stock based on genetic stock identification data and recoveries of CWTs from a hatchery indicator stock in distant fisheries and on the spawning grounds. The model has been used as a means of estimating escapement to the South Thompson for the years 2009, 2010, and 2011. Genetic samples collected in 2011 have not yet been genotyped and as a result the 2011 estimate has yet to be generated. The discussion provided below provides a summary of progress made in estimating the South Thompson escapement of Chinook salmon in the years 2009 and 2010.

This model was applied to data from 2009 for the South Thompson age 3 Chinook Aggregate, a significant component of the Fraser early model stock used by the CTC. The expected escapements for the South Thompson aggregate, based on data from the Fraser River gillnet test fishery (Albion) and NBC troll fishery were 169,000 (CV=6%) and 155,000 (CV = 17%), respectively. In 2010, the analysis was repeated using data from the same two fisheries collected within the same year. The expected escapements based on the 2010 data from the Fraser River gillnet test fishery (Albion) and NBC troll fishery were 107,[illegible]7 (CV=6%) and 214,434 (CV = 16%), respectively. The spawning escapement for the Middle Shuswap River, estimated by MR methods, was 5,038 (CV=6%) in 2010.

For 2009, the differences in the two estimates were minor and well within variation due to sampling error. Age-specific estimates of escapement were relatively precise in cases where the uncertainty in the expanded number of CWT recoveries in the fisheries was low. For 2010, the differences between the two estimates were pronounced with the Albion test fishery derived estimate being about one-half that produced when using NBC troll fishery data. The explanation for such a large difference between the estimates is

being investigated. Unlike 2009, the recovery of an age-5 CWT in the 2010 NBC troll fishery samples allowed for a more reliable estimate of escapement for the age class. Increasing the number of CWT recoveries remains essential to reduce uncertainty in age-specific escapement estimates. CWT releases for the Lower Shuswap River indicator continue at a higher level than previous. Beginning in 2010, tagging was increased from 250,000 to 500,000 CWT and adipose clipped fish, and a second year of tagging occurred at the Middle Shuswap River with 150,000 CWT and adipose clipped fish.

Chilko River Chinook Mark-Recapture, 2011

The 2011 escapement of Chinook salmon to the Chilko River, part of the Fraser River Summer-run "age-1.3" stock group, was estimated using a two event mark-recapture study, and concurrent aerial visual surveys. Petersen tags and sex-specific secondary marks were applied to 734 adult Chinook salmon captured using a combination of seining and angling (three tagged fish were harvested by the First Nation fishery). Recovery sampling was undertaken on carcasses, and 386 marked fish were recovered from a total recovery sample of 4,070 adult carcasses. The age composition of the recovery sample was 10% age 4, 88% age 5, and 2% age 6. All samples showed a stream-type life history with a two-year freshwater growth pattern. Only three tags were applied to jacks, of which none were recovered. There were only two jacks sampled during carcass recovery; therefore, a valid estimate of the jack escapement could not be calculated.

The results of the bias testing indicated that measurable sources of stress including holding time, marking, number of times recaptured, and release condition did not have a significant impact on the subsequent behaviour of the marked fish. Based on the mark-recapture field observations and aerial survey data, the mark-recapture assumption of closure was met. There was strong evidence of spatial bias in the application sample for both sexes and in the recovery sample for females. There was evidence of temporal bias in the recovery sample for males. Due to these temporal and spatial biases, the Stratified Population Analysis System (SPAS) was used to estimate escapements. The SPAS results confirmed that due to incomplete mixing there was a requirement to use the maximum likelihood (ML) Darroch method for both sexes. The adult spawning population estimate was 8,396 Chinook salmon(CV = 5%). The sex-specific escapement estimates were 3,515 males (CV = 11%) and 4,881 females (CV= 5%). The peak count estimate of escapement, based on the aerial survey data was 7,526; 10% less than the Darroch estimate. The measured peak count expansion factor was 1.72, using the peak count of 4,892 spawners, holders, and carcasses observed on September 13, 2011.

Chinook Escapement in the Skeena River Using Genetic Techniques, 2011 Estimate and Retrospective Analysis for the Years 1985-1989, 1991, 1993, 1997, 1998, 2002, 2004, and 2005.

The numbers of Chinook salmon returning to the Skeena River watershed each year were estimated using annual estimates of abundance in the Kitsumkalum River expanded by

the inverse of the annual proportions of Kitsumkalum River fish as genetically identified from samples collected at the Tyee Test Fishery. This summary includes results for four SSP programs; the 2009 to 2011 annual estimates and a retrospective program that examined twelve previous years.

The Skeena River has the second largest aggregate of Chinook salmon spawning populations in British Columbia and is one of the escapement indicator stocks defined by the Pacific Salmon Treaty for North/Central British Columbia. Chinook salmon escapements to the Skeena River are represented by an index that includes approximately 20 populations surveyed annually using a variety of techniques. The Kitsumkalum River is the exploitation rate indicator stock for the Skeena stock complex and spawning escapements for that river have been estimated using a mark-recapture program since 1984. Other escapement estimates that contribute to the index are based on fish weir counts and visual observations from helicopters, fixed wing aircraft, boats, and during foot surveys. The index of Chinook salmon escapement to the Skeena aggregate has averaged about 50,000 fish since 1984 (Appendix Table C-8). The Kitsumkalum River indicator stock represents approximately 30% of the spawners in the escapement index. The Bear River and Morice River populations have contributed 20 and 26% of the escapement index, respectively since 1984.

Appendix Table C.8. Skeena Chinook salmon escapement index, 1984 to 2011.

Year	Skeena Index	Year	Skeena Index	Year	Skeena Index
1984	35,864	1993	68,286	2002	44,771
1985	52,407	1994	22,611	2003	56,758
1986	59,719	1995	34,390	2004	39,552
1987	60,948	1996	73,684	2005	29,496
1988	68,307	1997	42,539	2006	36,682
1989	57,192	1998	46,774	2007	37,054
1990	55,541	1999	43,775	2008	34,615
1991	52,792	2000	51,804	2009	38,597
1992	67,118	2001	81,504	2010	43,331
				2001	37,073

Skeena Chinook salmon are encountered in the AABM fisheries in SEAK and NBC. They also contribute to the ISBM fisheries in NBC including gillnet, tidal sport, non-tidal sport, tidal First Nations' (FN) and non-tidal FN fisheries. The Skeena stock complex includes north migrating stocks, so the complex does not contribute to WCVI AABM fisheries nor to ISBM fisheries south of the Skeena River.

The retrospective project estimated Chinook salmon returns to the Skeena River using genetic stock identification techniques applied to archived scale samples. Genetic analyses of 6,951 Chinook salmon were completed from 7,383 fish sampled at the Tyee Test Fishery over 12 years: 1985 to 1989 inclusive, 1991, 1993, 1997, 1998, 2002, 2004 and 2005. The proportions of Kitsumkalum River Chinook salmon identified in the

annual samples were expanded to Skeena wide population estimates using the return of Kitsumkalum Chinook estimated from independent mark-recapture programs. The preliminary estimates of large Chinook salmon returning to the Skeena River as measured at Tyee ranged from 37,893 in 1986 to 146,836 in 2004. The coefficients of variation around the estimates were less than the CTC data standard of 15% in 7 years and were greater than 15% in 5 years (Appendix Table C-9).

The annual project estimated the 2011 return of Chinook salmon to the Skeena River using the same genetic stock identification techniques. Genetic analyses of 903 Chinook salmon caught at the Tyee Test Fishery identified 25.1% of the sample as Kitsumkalum Chinook salmon (SD = 1.8 percentage points). The preliminary escapement of large Chinook salmon to the Kitsumkalum River was estimated at 12,059 fish (SE = 2,433 fish) from an independent mark-recapture estimate. The estimate of large Chinook salmon returning to the Skeena River as measured at Tyee was 48,125 fish with a standard deviation of 10,287 fish (CV = 21.4%).

Appendix Table C.9. Preliminary escapement estimates for the aggregate of Skeena River Chinook salmon populations caught at Tyee from the 2011 SSP retrospective project and for the 2009 to 2011 annual SSP projects.

Year	Kitsumkalum Mark-Recapture Estimate	CV of Kitsumkalum Mark-Recapture Estimate	Weighted Proportion of Kitsumkalum at Tyee from DNA	CV of Kitsumkalum Proportion	Total Skeena Chinook Estimate	CV of Skeena Estimate
1985	8,304	5.9%	20.7%	13.7%	40,042	14.9%
1986	9,109	5.9%	24.0%	14.7%	37,893	15.9%
1987	23,657	10.1%	15.7%	14.1%	150,451	17.4%
1988	22,267	6.9%	22.3%	11.2%	99,877	13.1%
1989	17,925	7.2%	21.4%	11.2%	83,955	13.3%
1991	9,288	7.2%	19.4%	11.3%	47,894	13.4%
1993	14,059	5.5%	12.0%	15.2%	116,702	16.2%
1997	5,342	11.3%	8.6%	17.7%	61,925	21.0%
1998	11,065	6.8%	15.2%	15.5%	73,028	16.9%
2002	23,849	11.4%	27.6%	5.9%	86,377	12.8%
2004	25,767	10.2%	17.5%	8.4%	146,836	13.2%
2005	15,046	9.2%	19.0%	8.0%	79,088	12.2%
2009	10,703	13.3%	13.2%	10.7%	80,867	17.1%
2010	13,712	14.8%	14.7%	13.5%	93,121	20.1%
2011	12,059	20.2%	25.1%	7.1%	48,125	21.4%

The 2011 escapement estimate for the Kitsumkalum River had a CV of 20%. The failure of the Kitsumkalum program to provide a result that would allow the genetic program at Tyee to meet the data standard for the Skeena estimate was largely due to extreme

environmental conditions during the 2011 mark-recapture program. Water levels during the dead pitch in early September exceeded those experienced during the June freshet.

These results are preliminary as additions and modifications are scheduled for the genetic baseline for Skeena River Chinook salmon populations. The ultimate objective for retrospective and the annual SSPs on the Skeena River is to provide aggregate escapement estimates for the complete time series from 1979 to 2013.

While the projects have not met the data standard in eight of 15 years, the estimates represent an improvement over existing indices since comparisons may be made between years and across component stocks. Further, the estimates include estimates of variance. Variance estimates cannot be produced for the escapement indices of Skeena Chinook because of the combinations of different escapement techniques involved.

Estimate of Aggregate Population Upper Nass, 2011

The Upper Nass River Chinook salmon aggregate stock (hereafter referred to as Nass Chinook salmon) is a wild indicator stock used by the CTC. It is a large stock group of 16 separate populations spawning in the Nass River watershed, upstream of and including Tseax River, and has averaged about 21,000 spawners over the last decade (2001-2010). Nass Chinook salmon are an important contributor to the Pacific Coast Chinook salmon resource and represent a very stable proportion of the Chinook salmon stocks taken in the AABM and ISBM fisheries in NBC and SEAK. Nass Chinook salmon are a completely natural population with no history of enhancement and likely, very little, if any, straying from other enhanced systems.

Since 1994, escapement estimates for Nass Chinook salmon have been derived using mark-recapture methodology. Adult Chinook salmon ($\geq$ 50 cm nose-fork length) are marked at fishwheels operated on the lower Nass River by applying numbered aluminum "chick-wing" tags to the left operculum. Live fish are subsequently examined for marks at the Meziadin Fishway and both live fish and carcasses are examined for marks in other Upper Nass River tributaries. Recovery locations have varied over the years but have normally included Damdochax Creek and Kwinageese River which together represent approximately 30% of the Upper Nass Chinook salmon aggregate stock.

From 1994 to 2008, Nass Chinook salmon mark-recapture estimates achieved CV $\leq$ 15% in 9 of 15 (60%) years. The main factor influencing the CV has been the number of marked Chinook salmon examined and recovered at terminal spawning areas in the Upper Nass River watershed. Recoveries of marked Chinook salmon at the Meziadin Fishway alone have not been sufficient to generate precise mark-recapture estimates for the Upper Nass River Chinook salmon aggregate; hence, additional recovery efforts on other tributaries are required each year to achieve a CV of 15% or less. From 2009 to 2011 (Years 1 to 3), SSP funding has been used to assist in achieving a more precise mark-recapture estimate for Nass Chinook salmon. The funding received in 2009 helped achieve the CV standard by permitting sufficient tag-recovery efforts (CV = 13%). Two

key recommendations were made from the 2009 study: 1) to operate a third fishwheel at Gitwinksihlkw (GW) to increase mark rates of all size groups for assessing any potential size selective biases associated with the aggregate mark-recapture estimate, and 2) to continue mark recovery operations at Meziadin Fishway, the Kwinageese weir and Damdochax Creek. In 2010, due to extreme low water levels resulting in below average adult Chinook salmon catches, only 363 Chinook salmon were marked at the fishwheels despite the operation of a third fishwheel at GW (FW 7). The mark-recapture estimate in 2010 did not meet the data standard due to the low number of marks applied and recovered (CV = 25%). A key recommendation from 2010 was that to ensure application of at least 1,000 marks on the aggregate population, marking shouldalso occur at the upper fishwheels at Grease Harbour (GH) if a target of 415 marks was not reached at the GW fishwheels by 23 June.

In 2011, 589 adult Chinook salmon were marked at three fishwheels (FW1, FW2 and FW7) operated on the lower Nass River near the community of GW from 1 June to 17 September. As only 143 Chinook salmon had been marked at these fishwheels by 23 June, marking was also initiated at three fishwheels at GH (FW3, FW5 and FW6) where an additional 843 Chinook salmon were marked from 23 June to 6 September. Marking from all six fishwheels resulted in a total of 1,432 marked fish released, and after accounting for removals by in-river fisheries and estimated tagging related mortality (n = 287 censored), 1,145 marked fish were available for recovery in upstream tributaries. A total of 1,157 fish were examined for marks at mark-recovery sites of which 123 were marked from the fishwheels (overall mark rate = 10.6%).

Tests for size, sex, age, temporal, and spatial bias in capture and recovery samples were conducted in 2011. Size selectivity bias was detected for both the mark application and recovery samples. On average, Chinook salmon marked at the fishwheels were smaller than those examined in tributaries (Kolmogorov-Smirnov two-sample test; D= 0.175, $P < 0.001$) and the mark rate was higher for medium (50-75.4 cm nose fork length) than large ($\geq$ 75.5 cm nose fork length) fish examined in tributaries ($\chi^2 > 23$, df = 1, $P < 0.001$). Marked, censored, and examined Chinook salmon were therefore stratified by size, producing adjusted Petersen population estimates of 1,738 (SE = 225; CV = 15.1%) medium and 8,467 (SE = 894; CV = 11.1%) large Chinook salmon spawning between GW and GH or passing upstream of GH. Summing the stratified estimates produced an overall escapement estimate of 10,205 Chinook salmon (SE = 922; CV = 8.9%) which was similar (~500 fish lower) to the estimate generated by pooling size classes of 10,701 Chinook salmon (SE = 904; CV = 9.0%). Subtracting the in-river harvests above GH (566) from the stratified overall escapement yielded a net escapement estimate of 9,639 (95% C.I.: 7,794-11,483)adult Chinook salmon spawners above GW. Adding the catch (1,979) of Chinook salmon from all fisheries above GW to the net escapement estimate yielded an estimate of the total return of adult Chinook salmon to GW in 2011 of 11,618 fish (95% C.I.: 9,773-13,462). The 2011 return represented the second lowest return of Nass Chinook salmon since the start of the fishwheel program in 1994. Chinook salmon marked at the fishwheels in 2011 were 60% age 5, 35% age 4, 4% age 6, and 1% age 3.

If marking had not been initiated at GH in 2011, it is likely that the Nass Chinook salmon mark-recapture escapement estimate would not have met the CTC data standard (i.e., CV $\leq$ 15%). Therefore, we recommend that in future years, marking of Chinook salmon occur at both the GW and GH fishwheels from the beginning of the season, with an additional fishwheel being operated at GH (FW 4) rather than GW (FW 7). If 400 tags have been applied at the GW fishwheels by 23 June,it is recommend that marking at GH be limited to two of four fishwheels to reduce handling of fish. In addition,it is recommend that mark-recovery efforts continue at the Meziadin Fishway, Kwinageese River and Damdochax Creek. In 2011, SSP funding was sufficient to support the operation of a third fishwheel at GW; mark-recovery efforts at Kwinageese, Damdochax, and other systems; and additional marking efforts at the GH fishwheels. In addition, SSP funding assisted in monitoring salmon returns to the Kwinageese River in 2011 after successful remediation of a barrier caused by a rock slide in the lower river.